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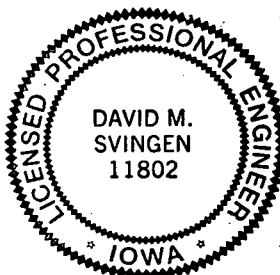
ANNUAL MONITORING REPORT 2003
GROUNDWATER QUALITY AND
MONITORING WELL PERFORMANCE

Reviewed
02/12/04
Randa

MONONA COUNTY SANITARY LANDFILL
MONONA COUNTY, IOWA
FACILITY NO. 67-SDP-1-75P

Terracon Project No. 40915034
November 26, 2003

I hereby certify the portion of this engineering document described below was prepared by me or under my direct personal supervision and that I am a duly licensed Professional Engineer under the laws of the State of Iowa.



David M. Svingen
David M. Svingen

Certificate No. 11802

Pages or sheets covered by this seal: Annual Report 2003
Pages 1 - 9; Appendix A - Figures 1 - 6; Appendix B;
Appendix C - Tables 1 - 3; Appendix D

Date Issued: 11/26/03
License Renewal Date: 12/31/03

Prepared for:

MONONA COUNTY SANITARY LANDFILL COMMISSION
Monona County, Iowa

Prepared by:
TERRACON
Omaha, Nebraska

Terracon

November 26, 2003

Monona County Sanitary Landfill Commission
c/o Mr. Harold Johnston
31342 State Highway 37
Turin, IA 51059

Terracon

2211 South 156th Circle
Omaha, Nebraska 68130
(402) 330-2202 Fax: (402) 330-7606

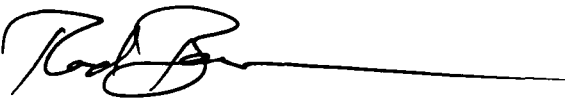
Re: Annual Monitoring Report 2003
Groundwater Quality and Monitoring Well Performance
Monona County Landfill
Permit No. 67-SDP-1-75P
Terracon Project No. 40915034

Dear Mr. Johnston:

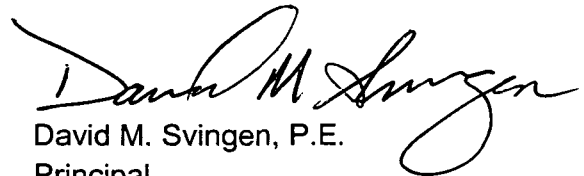
Enclosed is a report for the annual monitoring of groundwater quality and monitoring well performance for the Monona County Landfill. This report serves to meet Iowa Department of Natural Resources (IDNR) annual monitoring reporting requirements set forth in IDNR's Regulations for Solid Waste Disposal, Chapter 103. This report does not, however, contain site inspection/special waste authorization information. We understand that site inspection/special waste authorization information is to be reported by Virtue Engineering, the registered design engineer as specified in the landfill's permit (No. 67-SDP-1-75P).

Thank you for the opportunity to be of continued service to you on this project. If there are any questions concerning this report, please contact us.

Sincerely,
TERRACON



Rod Baumann, P.G.
Project Geologist



David M. Svingen, P.E.
Principal
Iowa License No. 11802

RMB/DMS:rmb/yms/leb

Enclosure

Copies to: Addressee (1)
Solid Waste Section, IDNR, Wallace State Office Building, 900 East Grand Avenue, Des Moines, IA 50319-0034 (1)
IDNR, Field Office No. 4, 706 Sunnyside Lane, Atlantic, IA 50022 (1)

Arizona ■ Arkansas ■ California ■ Colorado ■ Georgia ■ Idaho ■ Illinois ■ Iowa ■ Kansas ■ Kentucky ■ Minnesota ■ Missouri
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**ANNUAL MONITORING REPORT 2003
GROUNDWATER QUALITY AND
MONITORING WELL PERFORMANCE**

**Monona County Landfill
Permit No. 67-SDP-1-75P**

**Terracon Project No. 40915034
November 26, 2003**

1.0 INTRODUCTION

The subject site is an existing landfill operating under Iowa Department of Natural Resources (IDNR) permit number 67-SDP-1-75P, in Monona County of western Iowa. The Monona County Landfill is located within the Southwest $\frac{1}{4}$ of Section 13, in Township 83 North, Range 44 West, in Monona County, Iowa and its location is depicted in Figures 1 and 2 (Appendix A).

Terracon has completed semi-annual water quality sampling and analysis for the 2003 calendar year at the Monona County Landfill in general accordance with the IDNR approved Hydrologic Monitoring System Plan (HMSP), dated February 28, 1995. Semi-annual monitoring consisted of sampling and analyzing groundwater from a total of five water table monitoring wells (one up-gradient well and four down-gradient wells). Surface water sampling and analysis at two locations is also part of the HMSP, but surface water was not present during sampling episodes and was, therefore, not collected. The wells and surface water sampling locations are depicted in Figure 3 (Appendix A). Sampling was performed on the following dates:

- May 2, 2003
- October 22, 2003

Water samples were analyzed for routine annual and semi-annual parameters as specified in Section 103.2(4)e and 103.2(4)f of the Iowa Administrative Code (IAC). Laboratory reports, chain-of-custody documentation, and field data forms have been previously submitted to the IDNR for each semi-annual monitoring event. Copies of these semi-annual documents are retained at the Monona County Landfill.

2.0 STATISTICAL CONSIDERATIONS

Monitoring well MW-5 was considered as the up-gradient location in the water quality monitoring program for semi-annual parameters in groundwater. Surface water was not collected during the background monitoring period and statistical analyses were, therefore, not performed for surface water.

Statistical evaluation of temperature has not been included since temperature data, to a large degree, is dependent upon ambient conditions. Ambient conditions may cause temperature readings to deviate from actual groundwater conditions as a result of the method used to measure groundwater temperatures. Nevertheless, temperatures recorded during the background sampling events do not indicate obvious indications of temperature fluctuations which may be the result of endothermic or exothermic chemical reactions.

Control bounds were computed in general accordance with guidelines set forth in IAC 103.2(6). One-half of the laboratory method detection limit (MDL) was used in statistical computations in instances where chemicals were reported at concentrations below the MDL.

Laboratory analytical summary sheets for each sampling location have been provided in Appendix B. Graphs with control limits showing the concentrations versus time for sampling locations are also included in Appendix B. The semi-annual and annual parameters given statistical consideration are as follows:

Chloride ✓	Chemical Oxygen Demand (COD) ✓
Iron (dissolved) ✓	Ammonia Nitrogen ✓
pH ✓	Specific Conductance ✓
Phenols (total) ✓	Total Organic Halogens ✓

3.0 GROUNDWATER IMPACT DISCUSSIONS

Discussion in this section is provided for chemical parameters that fall outside of the upper and lower control limits on a well-by-well basis. Chemical parameters which fall within established control limits are not discussed. Well discussions are presented in reverse order of the well number system (i.e. well MW-5 is discussed first and well MW-1 is discussed last) since this order generally follows an up-gradient to down-gradient progression.

Upper and lower control limits for each of the monitoring wells (MW-1 through MW-5) were based on data obtained for up-gradient well MW-5 as required by IAC Chapter 103.2(b). In some cases, upper and lower control limits are equivalent due to non-detection of certain parameters since monitoring began. In this case, analyte concentrations plot on a single control bound line (no deviation from the mean of the data) instead of between upper and lower control bounds.

3.1 MW-5 (Up-Gradient Well)

Analytes whose concentrations fall outside of the control limits established from up-gradient well MW-5 are as follows:

- **Chemical Oxygen Demand:** The June 29, 1996 data point plotted above the upper control limit. Compared to the other data points on the graph, the data point exceeding the upper control limit appears to be anomalous. Monitoring after the June 29, 1996 measurement indicates that the suspect data point is anomalous and not consistent with other monitoring data for chemical oxygen demand at MW-5.
- **Ammonia Nitrogen:** The October 22, 2003 data point plotted above the upper control limit. Prior ammonia concentrations have not been detected in well MW-5 and the October 22 data point appears to be anomalous at this time. Future monitoring should indicate whether ammonia will continue to be detected or if the current ammonia data point will be an anomaly on the analysis graph. X
- **pH:** The October 28, 1997 data point on the pH graph for MW-5 is anomalously low. The anomalous value of this data point may be attributable to error of the field instrument used to measure pH. Monitoring data for sampling events preceding and subsequent to the October 28, 1997 measurement indicates that the data point is anomalous and not consistent with other monitoring data for pH at MW-5.
- **Specific Conductance:** The April 28, 1998 data point plotted marginally below the lower control limit. This marginal deviation from the control limits is not considered to be statistically significant.

3.2 MW-4 (Down-Gradient Well)

Analytes whose concentrations fall outside of the control limits established from up-gradient well MW-5 are as follows:

- **Iron:** Any detection of iron in a down-gradient well will fall outside the control limits established by up-gradient well MW-5. The June 29, 1996 data point plotted above the control limits but appears to be anomalous, based on data which precedes and follows the suspect sampling date. The anomalous iron concentration is not consistent with other monitoring data for iron at MW-4.

- **Ammonia Nitrogen:** The May 2, 2003 and October 22, 2003 data points plotted above the upper control limit. Prior ammonia concentrations have not been detected in well MW-4. At this time, it is not clear if recent ammonia detections indicate the beginning of a trend or whether these recent data points will ultimately prove to be anomalous. Future monitoring is necessary to further evaluate the recent ammonia detections.
- **Specific Conductance:** The August 30, 1996 and October 20, 1996 data points plotted marginally below control limits. The remaining data points are within the control limits. The suspect data points do not warrant concern at this time.

3.3 MW-3 (Down-Gradient Well)

There were no analytes whose concentrations fell outside the control limits established from up-gradient well MW-5.

3.4 MW-2 (Down-Gradient Well)

Analytes whose concentrations fall outside of the control limits established from up-gradient well MW-5 are as follows:

- **Chloride:** Most of the data points plotted above the upper control limit for chloride. Based on other indications of groundwater impact at well MW-2 (i.e. total organic halogens), the chloride concentrations may be indicative of impact from the landfill.
- **Chemical Oxygen Demand:** The June 29, 1996 and May 2, 2003 data points plotted above the upper control limit for specific conductance. Other data points plotted within the control limits. These two data points do not warrant concern at this time. In particular, the May 2, 2003 data point may be anomalous.
- **Iron:** Any detection of iron in a down-gradient well will fall outside the control limits established by up-gradient well MW-5. The October 24, 1999; April 26, 2000; and October 15, 2002 data points plotted above the upper control limit for iron. At this time, it appears that the detections of iron are anomalous and not consistent with other monitoring data for iron at MW-2. Continued monitoring will allow for further assessment of potential iron impact at well MW-2.
- **Ammonia Nitrogen:** The October 15, 1998 data point plotted above the upper control limit for ammonia. It appears that the detection of ammonia is anomalous and not consistent with other monitoring data for ammonia at MW-2.

- **Total Organic Halogens:** Any detection of total organic halogens in a down-gradient well will fall outside the control limits established by up-gradient well MW-5. Detections of total organic halogens have occurred for each monitoring event where sampling and analysis for routine annual parameters was performed, except the most recent monitoring event (October 2003). Results are consistent with detection of 1,1,1-trichlorethane (TCA) compounds made during quarterly background monitoring which took place in 1996. TCA concentrations reported at that time were below the Iowa numerical action level of 200 µg/l. The 200 ug/l is currently a numeric standard for protected groundwater sources in Iowa and is also a federal drinking water standard (health advisory level and maximum contaminant level).
- **Specific Conductance:** Several data points plotted above the upper control limit for specific conductance. Based on other indications of groundwater impact at well MW-2 (i.e. total organic halogens and chloride), the specific conductance concentrations may be indicative of impact from the landfill. Continued monitoring will allow for further assessment of elevated specific conductance at well MW-2.

3.5 MW-1 (Down-Gradient Well)

Analytes whose concentrations fall outside of the control limits established from up-gradient well MW-5 are as follows:

- **Chemical Oxygen Demand:** The June 29, 1996 data point plotted above the upper control limit for chemical oxygen demand. It appears that the detection is anomalous and not consistent with other most other monitoring data for chemical oxygen demand at MW-1.
- **Iron:** Any detection of iron in a down-gradient well will fall outside the control limits established by up-gradient well MW-5. Dissolved iron was detected during the first monitoring event and again in October of 1999, 2001, and 2002. The detectable iron concentrations plotted above the upper control limit but appear to be anomalous and not consistent with other monitoring data for iron at MW-1.
- **Ammonia Nitrogen:** Ammonia nitrogen was detected during the October 15, 1998 monitoring event. The detectable ammonia nitrogen concentration plotted on the upper control limit but appears to be anomalous and not consistent with other monitoring data for ammonia nitrogen at MW-1.

- **Total Organic Halogens:** Any detection of total organic halogens in a down-gradient well will fall outside the control limits established by up-gradient well MW-5. Detections of total organic halogens occurred in six of eight monitoring events where sampling and analysis for routine annual parameters was performed. Specific halogenated VOCs were not detected in groundwater from MW-1 during quarterly background sampling performed in 1996, as they were in groundwater from well MW-2. Wells MW-1 and MW-2 are located at the down-gradient side of the landfill (see Figure 3, Appendix A).
- **Specific Conductance:** Three of the last four sampling events have revealed specific conductance values plotting above the upper control limit. It is possible that an upward trend in specific conductance may be occurring, especially since impact to groundwater from total organic halogens has been apparent for the past few years. Continued monitoring will allow for further assessment of recent increased specific conductance at well MW-1.

4.0 MONITORING WELL PERFORMANCE

The current site monitoring instruments were evaluated in general accordance with the approved Hydrologic Monitoring System Plan, dated February 28, 1995. The purpose of this evaluation was to assess whether the integrity of groundwater monitoring instruments is sufficient to adequately monitor groundwater at the landfill as described in the approved HMSP.

4.1 Well Location Evaluation [110.9(2)a]

For the 2003 calendar year, groundwater elevation measurement events for five water table monitoring wells (see Figure 3, Appendix A) were conducted monthly by landfill personnel. The results of these events have been tabulated in Table 1 (Appendix C).

Water levels of individual wells have remained relatively consistent over the past year. In other words, no significant variation in water level fluctuations have occurred for individual wells over the course of the monitoring period. Water levels at MW-1 and MW-2 have remained within the screened interval throughout the year. Water levels measured in wells MW-3, MW-4, and MW-5 were consistently above each well's screened interval. This comparison is made in Table 1 (Appendix C). The water levels were consistently within one foot of the top of the well screen in well MW-4; between two and three feet above the top of the well screen in well MW-5; and ½ to 3 feet above the well screen in well MW-3.

Ideally, water levels should be within the screened interval for water table monitoring wells, particularly to monitor for the presence of non-aqueous phase liquids (NAPLs) which collect at

the water table surface. However, evidence to indicate the possible presence of NAPLs at the monitoring wells was not observed in 2003. As long as such evidence of potential NAPL presence is not observed when the water table is within a few feet above the top of the screened interval, the well will suffice as a viable groundwater monitoring point.

The general direction of groundwater flow was evaluated for each month's data. The general groundwater flow direction has not changed since groundwater flow was assessed in 1993 for the hydrogeologic assessment. To demonstrate this finding, water level data from three arbitrarily selected monitoring dates was used to construct water table contour maps (Figures 4, 5, and 6, Appendix A). The inferred groundwater flow direction shown on these maps is similar to the inferred groundwater flow direction depicted on maps presented in the hydrogeologic assessment report and previous annual groundwater monitoring reports.

Based on the above findings, the monitoring wells' positioning, with respect to well depth (vertical) and also with respect to location along the buried waste perimeter (lateral), continues to be adequate. Up-gradient and down-gradient well designations as described in the HMSP should continue to be used.

4.2 Effects of Landfill Operations on Hydrogeologic Setting [110.9(2)b]

Methods for landfilling of solid waste throughout 2003 have not varied significantly from original landfilling methods employed when landfilling commenced in 1975. Based on groundwater information discussed above in Section 4.1, it does not appear that landfill operations are altering the hydrogeologic setting at the landfill site. X

4.3 Well Sedimentation [110.9(2)c]

According to the approved HMSP, well depths need to be measured annually to evaluate if the wells are physically intact and not filling with sediment. Well depths were measured during semi-annual monitoring events and recorded on IDNR form 542-1322 which accompanied semi-annual analytical reports submitted to the IDNR and retained at the landfill. The results of these measurements, when compared with well depths depicted on boring logs included in the hydrogeologic assessment report (dated February 28, 1995), show that significant silting of site monitoring instruments has not occurred.

4.4 Periodic In-Situ Permeability Tests [110.9(2)d]

According to the approved HMSP, hydraulic conductivities are to be evaluated at monitoring instruments once every five years. Hydraulic conductivity evaluation of the monitoring instruments was performed during November of 1992 and October of 1998. Summaries of

hydraulic conductivity testing are documented in the 1992 and 1998 annual reports. Hydraulic conductivity measurements were conducted again in 2003. Results of the 2003 hydraulic conductivity testing are summarized in Table 3 (Appendix C) along with results obtained from prior years testing. Hydraulic conductivity data and analysis sheets are contained in Appendix D.

The test data indicate relative consistency (less than one order of magnitude difference) of hydraulic conductivity values between the test dates for individual wells, with the exception of well MW-2. Well MW-2 shows variation of nearly 1.5 orders of magnitude for the three testing events. Nevertheless, the lowest hydraulic conductivity result for MW-2 is indicative of adequate flow into the well for continued sampling. This premise is supported by the inability to purge well MW-2 to dryness through manual bailing during sampling events. Consequently, fouling of well screens by silt or bacteria is not considered to be a problem at this time. The wells continue to be viable for continued groundwater monitoring.

5.0 LEACHATE WELL MONITORING

Leachate levels were measured monthly by landfill personnel and during semi-annual monitoring by Terracon during 2003. Results of leachate measurements made at leachate wells (LW-1, LW-2, and LW-3) are summarized in Table 2 (Appendix C). Locations of leachate wells are depicted in Figure 3 (Appendix A).

Leachate in well LW-2 has reportedly been bailed on a monthly basis by landfill personnel to reduce leachate. Manual bailing occurs following monthly leachate measurements if leachate thickness is observed to be greater than about 1½ feet. The bailing is conducted until significant leachate volume can no longer be retrieved from the leachate well. Leachate liquid is reportedly stored in a holding tank at a waste transfer station located about one mile northwest of the landfill. Arrangements for disposal of the leachate have not yet been made.

6.0 GENERAL COMMENTS

The analysis and opinions expressed in this report are based upon data obtained from the monitoring wells installed at the indicated locations and from any other information discussed in this report. This report does not reflect any variations in subsurface chemistry, stratigraphy, or geohydrology which may occur between borings or across the site. Actual subsurface conditions may vary and may not become evident without further exploration.

This report is prepared for the exclusive use of our client for specific application to the project discussed and has been prepared in accordance with generally accepted environmental engineering practices. No warranties, either express or implied, are intended or made. In the

event any changes in the nature or location of observed conditions as outlined in this report are found, this report cannot be considered valid unless these changes are reviewed and the opinions of this report are modified or verified in writing by Terracon.

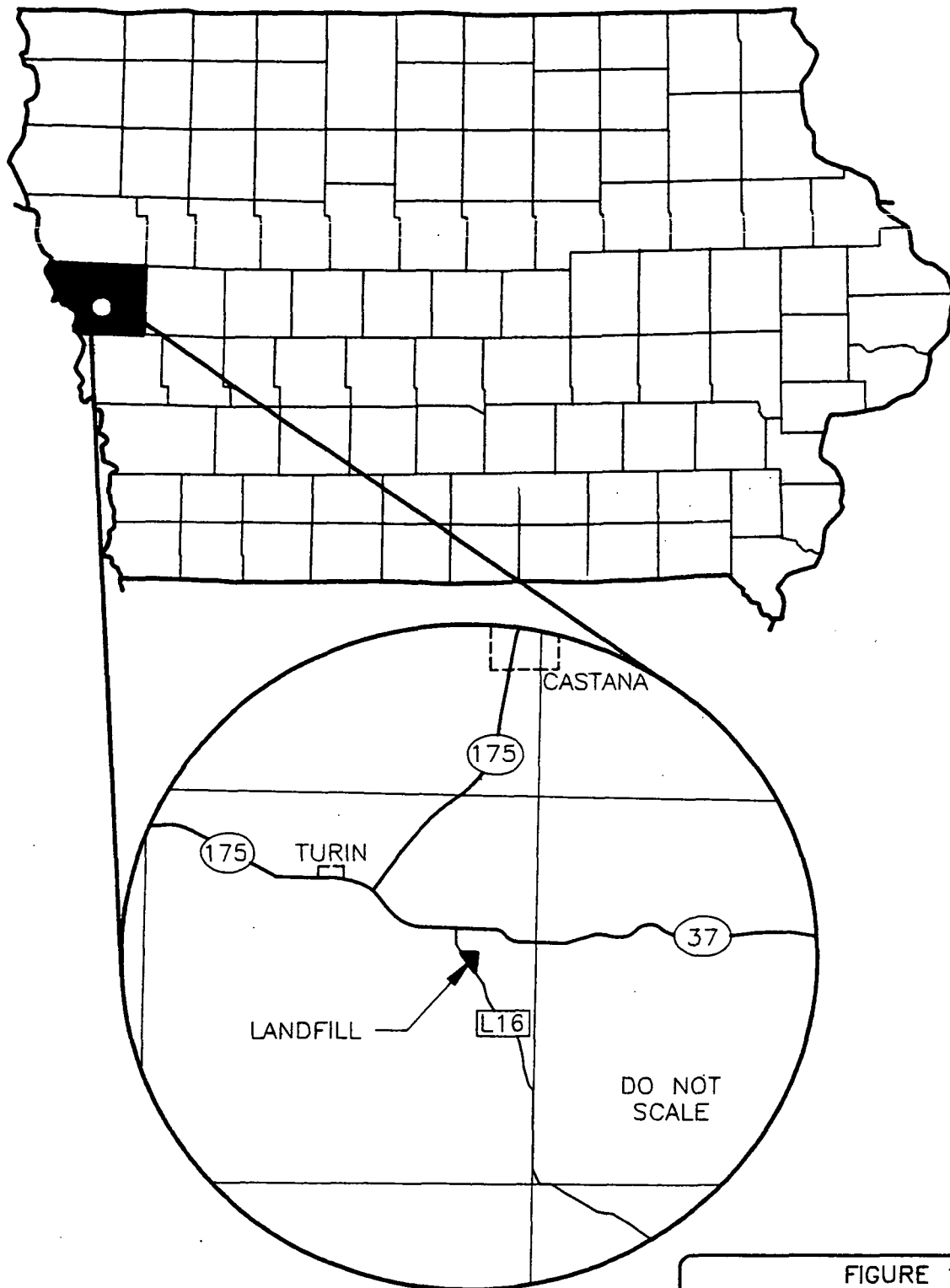
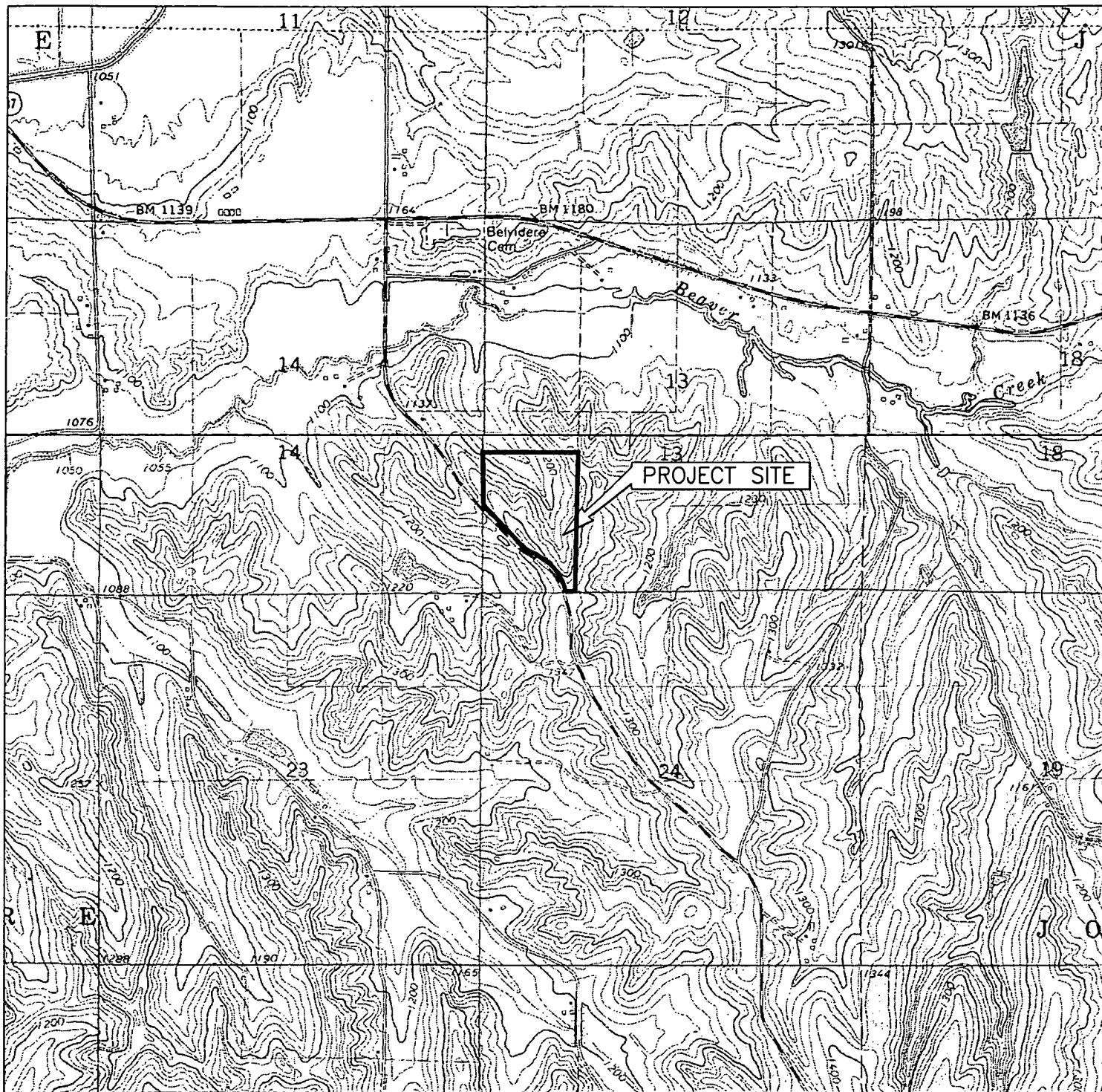


FIGURE 1
LOCATION DIAGRAM
MONONA COUNTY LANDFILL
MONONA COUNTY,
IOWA
PROJECT NO. 40915034
FILE NO. 1E034-1M



1293 x 2002
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 ~60
 ~40

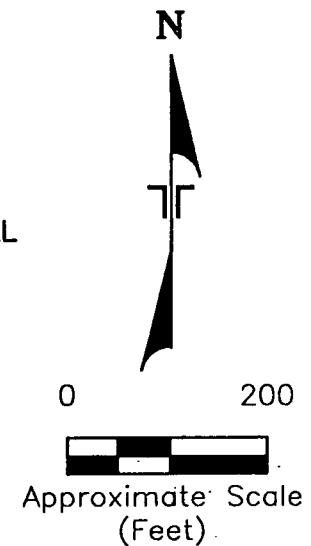
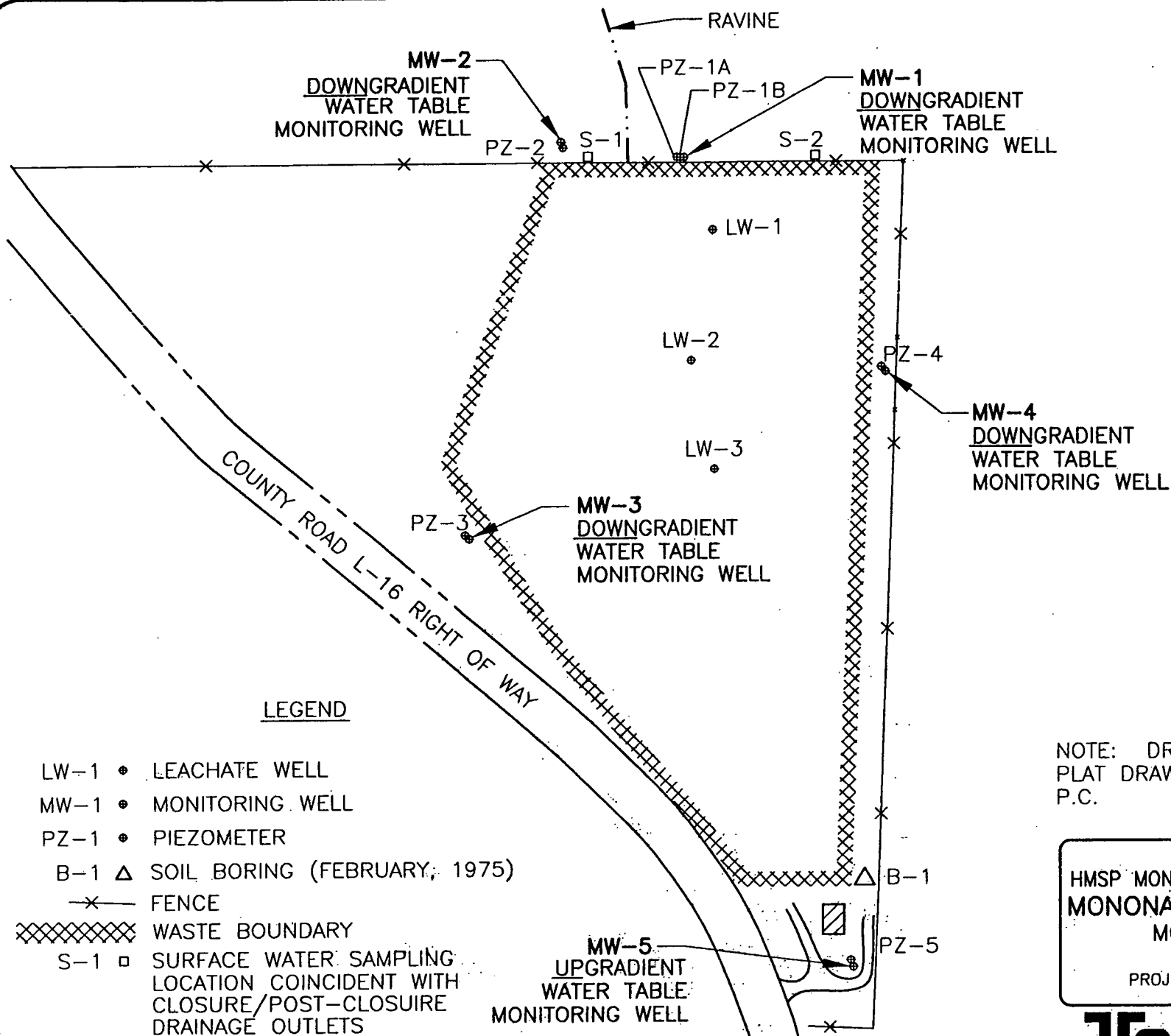
REGIONAL TOPOGRAPHIC MAP
 MONONA COUNTY LANDFILL
 MONONA COUNTY, IOWA

Project Mngr: RMB
 Designed By: RMB
 Drawn By: RSN
 Checked By: RMB
 Approved By: DMS

Terracon
 2211 S. 156th Circle
 Omaha, NE 68130

Project No. 40925130
 Scale: AS SHOWN
 File No. 2E130R15
 Date: MARCH 2001

Figure No.



NOTE: DRAWING MODIFIED AFTER PLAT DRAWING, VIRTUE ENGINEERING P.C.

FIGURE 3
HMSF MONITORING POINT LOCATIONS
MONONA COUNTY LANDFILL
MONONA COUNTY
IOWA
 PROJECT NO. 40915034
 FILE NO. 1E034-12

Terracon
 R2 CRB 2-17-95

(1187.08) MW-2
DOWNGRADIENT
WATER TABLE
MONITORING WELL

RAVINE

PZ-1A
PZ-1B

MW-1 (1189.93)
DOWNGRADIENT
WATER TABLE
MONITORING WELL

PZ-2 S-1

S-2

1195
• LW-1

1205
• LW-2

1210
• LW-3

1215
MW-3 (1217.95)
DOWNGRADIENT WATER
TABLE MONITORING WELL

1220

1225

1230

(1231.13) MW-5
UPGRADIENT
WATER TABLE
MONITORING WELL

PZ-4

MW-4 (1209.02)
DOWNGRADIENT
WATER TABLE
MONITORING WELL

△ B-1

PZ-5

LEGEND

□ GATEHOUSE BUILDING

LW-1 • LEACHATE WELL

MW-1 • MONITORING WELL

PZ-1 • PIEZOMETER

B-1 △ SOIL BORING (FEBRUARY, 1975)

— 1200 — GROUNDWATER ISOPLETH

➔ INFERRED GROUNDWATER FLOW DIRECTION

—X— FENCE

XXXXX WASTE BOUNDARY

S-1 □ SURFACE WATER SAMPLING
LOCATION COINCIDENT WITH
CLOSURE/POST-CLOSURE
DRAINAGE OUTLETS

NOTES:

1. WATER TABLE SURFACE CONTOURS ARE BASED ON INTERPOLATION BETWEEN WATER TABLE ELEVATIONS AT MONITORING WELLS. ACTUAL SUBSURFACE CONDITIONS MAY VARY.
2. NUMBERS IN PARENTHESIS AT MONITORING WELLS INDICATE WATER TABLE ELEVATIONS.
3. WATER TABLE ELEVATIONS ARE BASED ON MEASUREMENTS TAKEN ON JANUARY 2003.

N

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Approximate Scale (Ft.)
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NOTE: DRAWING MODIFIED AFTER
PLAT DRAWING, VIRTUE ENGINEERING
P.C.

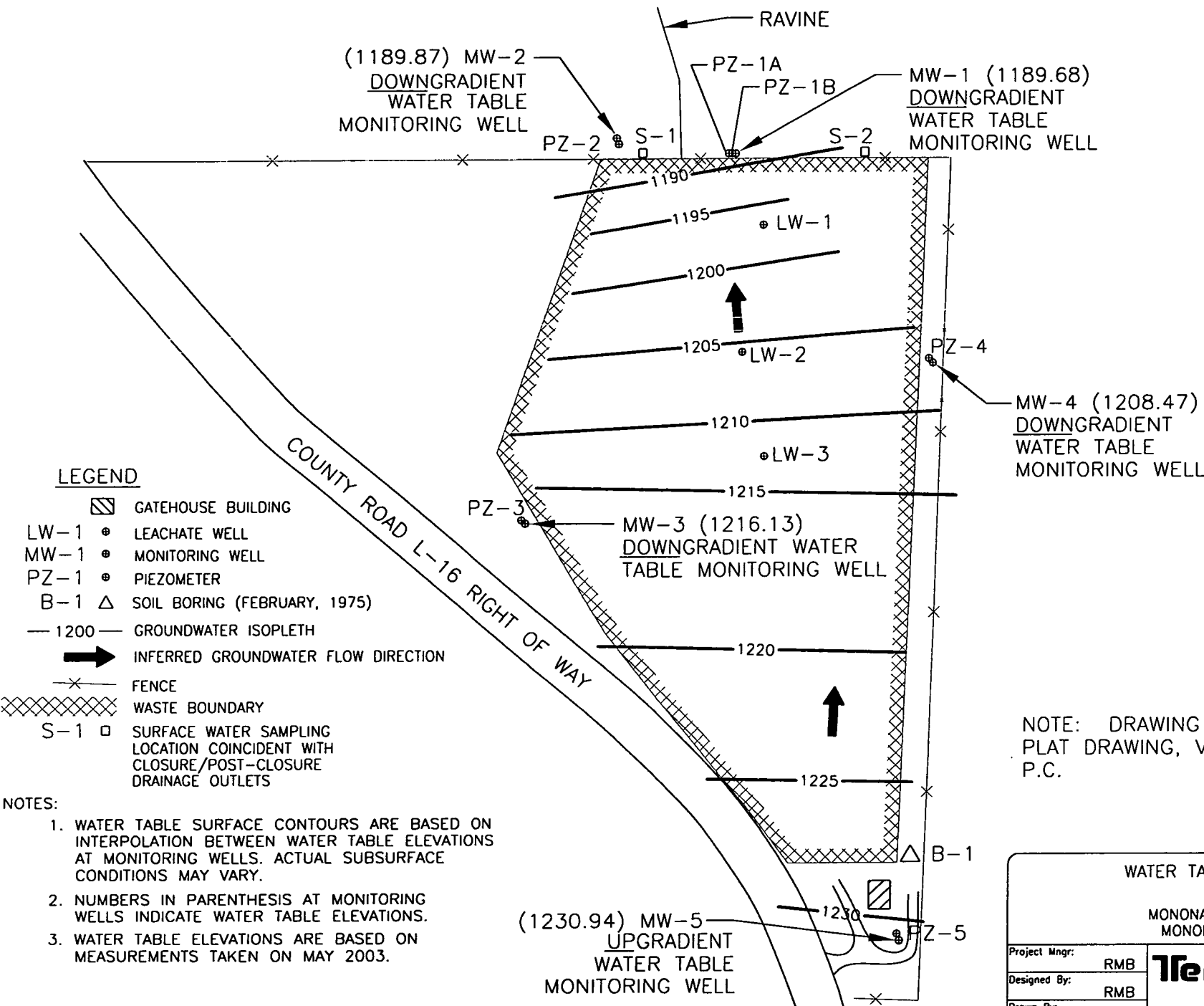
WATER TABLE CONTOUR MAP
JANUARY 2003
MONONA COUNTY LANDFILL
MONONA COUNTY, IOWA

Project Mng: RMB
Designed By: RMB
Drawn By: RSN
Checked By: RMB
Approved By: DMS

Terracon
2211 S. 156th Circle
Omaha, NE 68130

Project No. 40915034
Scale: AS SHOWN
File No. 1E034R22
Date: NOV. 2003

Figure No.

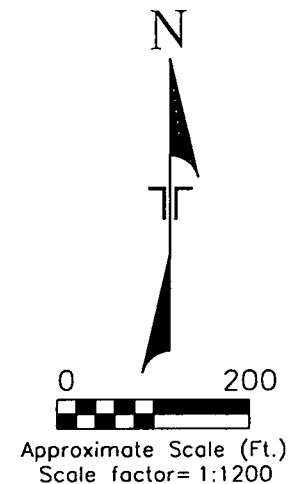


LEGEND

- GATEHOUSE BUILDING
- LW-1 • LEACHATE WELL
- MW-1 • MONITORING WELL
- PZ-1 • PIEZOMETER
- B-1 △ SOIL BORING (FEBRUARY, 1975)
- 1200 — GROUNDWATER ISOPLETH
- INFERRED GROUNDWATER FLOW DIRECTION
- FENCE
- WASTE BOUNDARY
- S-1 □ SURFACE WATER SAMPLING LOCATION COINCIDENT WITH CLOSURE/POST-CLOSURE DRAINAGE OUTLETS

NOTES:

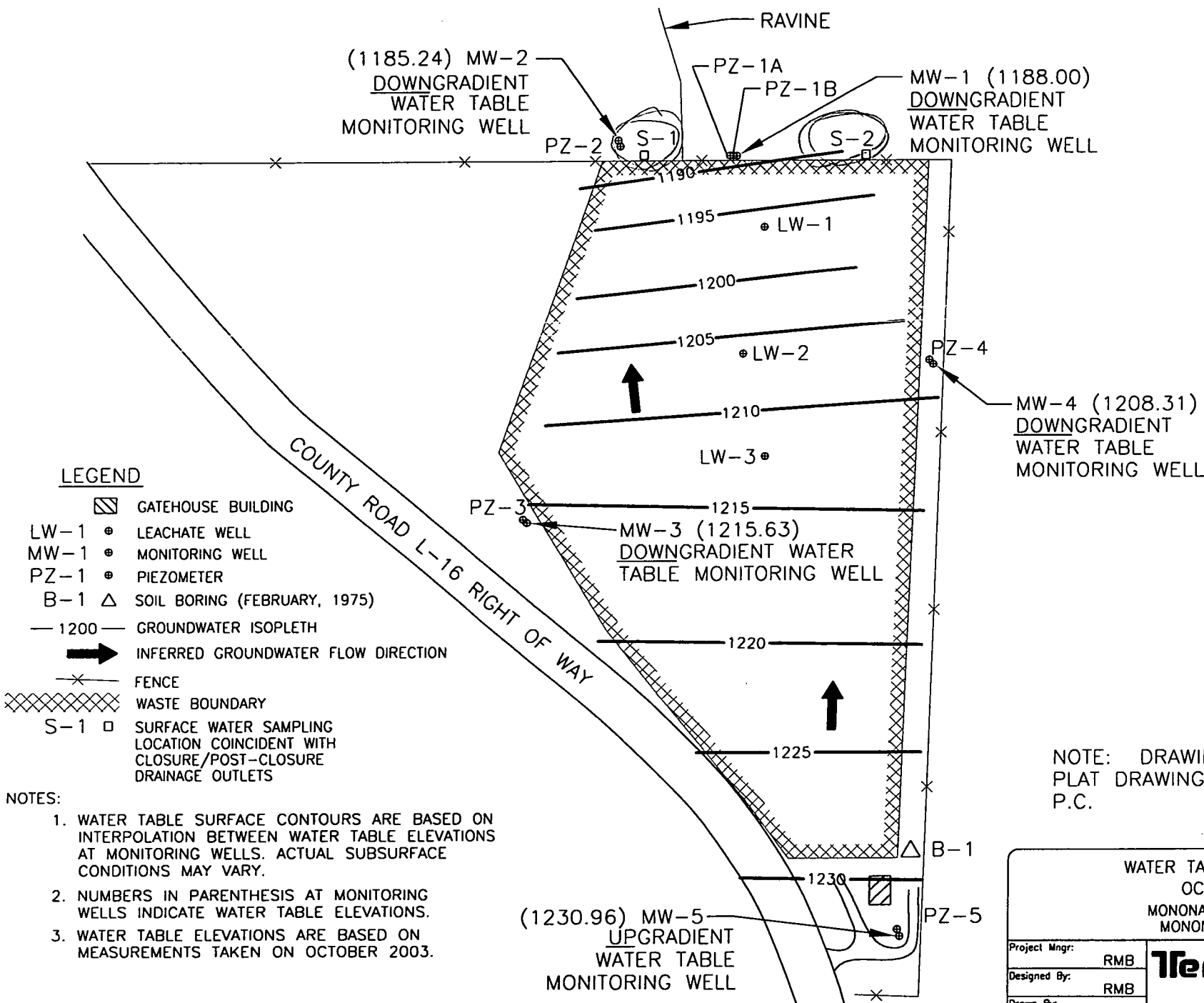
1. WATER TABLE SURFACE CONTOURS ARE BASED ON INTERPOLATION BETWEEN WATER TABLE ELEVATIONS AT MONITORING WELLS. ACTUAL SUBSURFACE CONDITIONS MAY VARY.
2. NUMBERS IN PARENTHESIS AT MONITORING WELLS INDICATE WATER TABLE ELEVATIONS.
3. WATER TABLE ELEVATIONS ARE BASED ON MEASUREMENTS TAKEN ON MAY 2003.



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WATER TABLE CONTOUR MAP
MAY 2003
MONONA COUNTY LANDFILL
MONONA COUNTY, IOWA

Project Mngr:	RMB	Terracon 2211 S. 156th Circle Omaha, NE 68130	Project No.	40915034
Designed By:	RMB		Scale:	AS SHOWN
Drawn By:	RSN		File No.	1E034R23
Checked By:	RMB		Date:	NOV. 2003
Approved By:	DMS		Figure No.	5

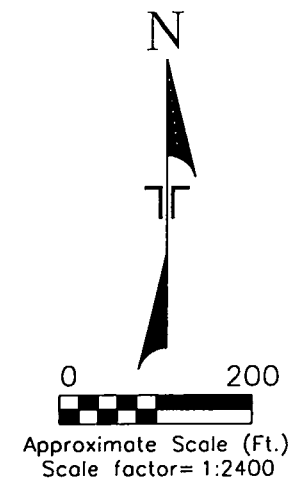


LEGEND

- GATEHOUSE BUILDING
- LW-1 • LEACHATE WELL
- MW-1 • MONITORING WELL
- PZ-1 • PIEZOMETER
- B-1 Δ SOIL BORING (FEBRUARY, 1975)
- 1200 — GROUNDWATER ISOPLETH
- INFERRED GROUNDWATER FLOW DIRECTION
- FENCE
- WASTE BOUNDARY
- S-1 □ SURFACE WATER SAMPLING LOCATION COINCIDENT WITH CLOSURE/POST-CLOSURE DRAINAGE OUTLETS

NOTES:

1. WATER TABLE SURFACE CONTOURS ARE BASED ON INTERPOLATION BETWEEN WATER TABLE ELEVATIONS AT MONITORING WELLS. ACTUAL SUBSURFACE CONDITIONS MAY VARY.
2. NUMBERS IN PARENTHESIS AT MONITORING WELLS INDICATE WATER TABLE ELEVATIONS.
3. WATER TABLE ELEVATIONS ARE BASED ON MEASUREMENTS TAKEN ON OCTOBER 2003.



NOTE: DRAWING MODIFIED AFTER PLAT DRAWING, VIRTUE ENGINEERING P.C.

WATER TABLE CONTOUR MAP OCTOBER 2003 MONONA COUNTY LANDFILL MONONA COUNTY, IOWA

Project Mng'r:	RMB		Project No.	40915034
Designed By:	RMB		Scale:	AS SHOWN
Drawn By:	RSN		File No.	1E034R24
Checked By:	RMB		Date:	NOV. 2003
Approved By:	DMS		Figure No.	6

2211 S. 156th Circle
Omaha, NE 68130

ANALYSIS SHEET MW-5

MONONA COUNTY LANDFILL GROUNDWATER SAMPLING AND ANALYSIS PROJECT No. 40915034

SEMI-ANNUAL AND ANNUAL ROUTINE PARAMETERS STATISTICAL ANALYSIS SHEET

SAMPLE LOCATION NO. **MW-5 (Up-gradient)**

ANALYSIS PERFORMED BY: **TEST AMERICA INC.**

SAMPLED BY: **TERRACON**

PARAMETER	Statistical Considerations				SAMPLE DATE													
	Upper Control Limit via MW-5	Lower Control Limit via MW-5	MW-5 Standard Deviation	MW-5 Mean	10/20/1995	3/29/1996	6/29/1996	8/30/1996	10/20/1996	5/27/1997	10/28/1997	4/28/1998	10/15/1998	4/20/1999	10/24/1999	4/26/2000	10/26/2000	
Laboratory Parameters																		
Chloride (mg/l)	18.1	2.05	4.02	10.09	2.5	2.5	5.8	5.4	6.7	9.3	9.9	12	9.8	11	11	11.6	12	
Chemical Oxygen Demand (mg/l)	14.4	0.00	5.00	4.39	2.5	2.5	24	2.5	2.5	5.9	5.7	2.5	2.5	2.5	2.5	2.5	2.5	
Iron, dissolved (mg/l)	0.05	0.05	0.00	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	
Nitrogen, Ammonia (mg/l)	0.30	0.00	0.09	0.12	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	
Phenols, total (mg/l)	0.01	0.01	0.00	0.01	-	-	-	-	0.01	-	0.01	0.01	-	0.01	-	0.01	-	
Total Organic Halogens (mg/l)	0.005	0.005	0.00	0.01	-	-	-	-	0.005	-	0.005	0.005	-	0.005	-	0.005	-	
Field Parameters																		
pH (SU)	8.21	5.50	0.68	6.85	6.7	7.4	7.20	7.2	7	6.8	4.3	7.1	6.8	7.4	7.0	7.0	7.2	
Specific Conductance (umho/cm)	1179	564	154	872	889	1026	816	680	691	849	644	534	942	1000	970	822	1130	

NOTE:

- 1) Results shown in bold represent one-half of the laboratory detection limit (MDL) [for parameters reported below the MDL].
- 2) One-half of the MDL was used for parameters reported at concentrations below their respective MDL to compute their respective control limits (mean +/- two times the standard deviation for the chemicals observed at MW-5).
- 3) One-half of the MDL was graphed for parameters reported at concentrations below their respective MDL.
- 4) A lower control limit of zero (0) was used for those parameters in which a negative lower control limit was calculated.
- 5) Results from Monitoring Well MW-5 were used to compute control limits - considered up-gradient well

ANALYSIS SHEET MW-5

**MONONA COUNTY LANDFILL
GROUNDWATER SAMPLING AND ANALYSIS
PROJECT No. 40915034**

SEMI-ANNUAL AND ANNUAL ROUTINE PARAMETERS STATISTICAL ANALYSIS SHEET

SAMPLE LOCATION NO. **MW-5 (Up-gradient)**ANALYSIS PERFORMED BY: **TEST AMERICA INC.**SAMPLED BY: **TERRACON**

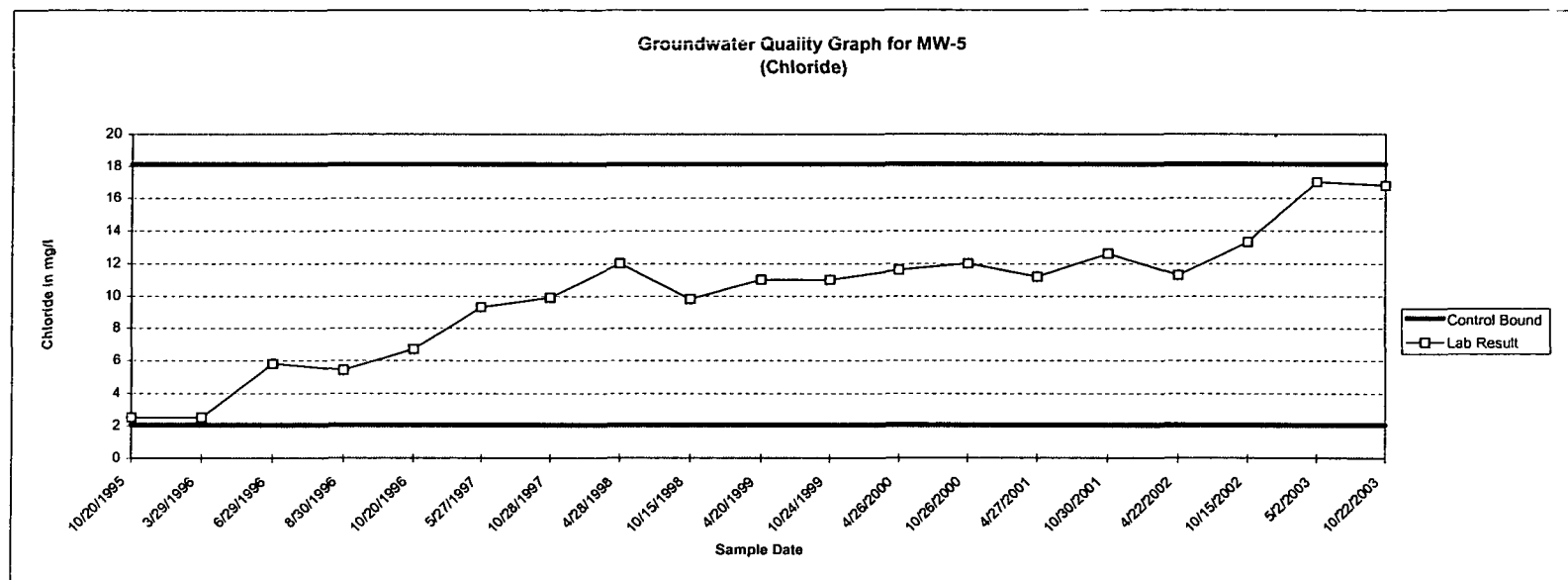
PARAMETER	Statistical Considerations				SAMPLE DATE					
	Upper Control Limit via MW-5	Lower Control Limit via MW-5	MW-5 Standard Deviation	MW-5 Mean	4/27/2001	10/30/2001	4/22/2002	10/15/2002	5/2/2003	10/22/2003
Laboratory Parameters										
Chloride (mg/l)	18.1	2.05	4.02	10.09	11.2	12.6	11.3	13.3	17.0	16.8
Chemical Oxygen Demand (mg/l)	14.4	0.00	5.00	4.39	2.5	2.5	2.5	2.5	7.6	5.2
Iron, dissolved (mg/l)	0.05	0.05	0.00	0.05	0.05	0.05	0.05	0.05	0.05	0.05
Nitrogen, Ammonia (mg/l)	0.30	0.00	0.09	0.12	0.1	0.1	0.1	0.1	0.1	0.49
Phenols, total (mg/l)	0.01	0.01	0.00	0.01	0.01	-	0.01	-	0.01	-
Total Organic Halogens (mg/l)	0.005	0.005	0.00	0.01	0.005	-	0.005	-	0.005	-
Field Parameters										
pH (SU)	8.21	5.50	0.68	6.85	7.0	7.0	7.0	6.1	6.9	7.1
Specific Conductance (umho/cm)	1179	564	154	872	900	941	1022	771	912	1022

NOTE:

- 1) Results shown in bold represent one-half of the laboratory detection limit (MDL) [for parameters reported below the MDL].
- 2) One-half of the MDL was used for parameters reported at concentrations below their respective MDL to compute their respective control limits (mean +/- two times the standard deviation for the chemicals observed at MW-5).
- 3) One-half of the MDL was graphed for parameters reported at concentrations below their respective MDL.
- 4) A lower control limit of zero (0) was used for those parameters in which a negative lower control limit was calculated.
- 5) Results from Monitoring Well MW-5 were used to compute control limits - considered up-gradient well

ANALYSIS SHEET MW-5
MONONA COUNTY LANDFILL
GROUNDWATER SAMPLING AND ANALYSIS
PROJECT No. 40915034

SEMI-ANNUAL AND ANNUAL ROUTINE PARAMETERS STATISTICAL ANALYSIS SHEET



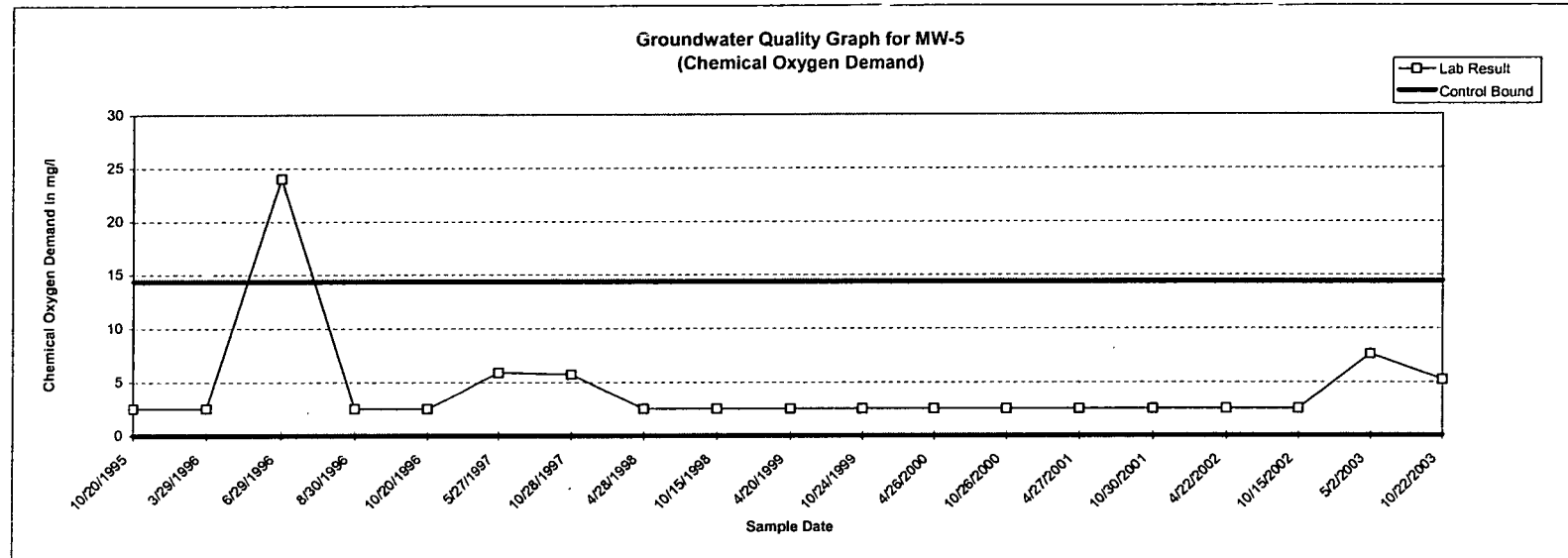
NOTE:

- 1) Results from Monitoring Well MW-5 were used to compute control limits - considered up-gradient well
- 2) One-half of the MDL was graphed for parameters reported at concentrations below their respective MDL.

ANALYSIS SHEET MW-5

MONONA COUNTY LANDFILL GROUNDWATER SAMPLING AND ANALYSIS PROJECT No. 40915034

SEMI-ANNUAL AND ANNUAL ROUTINE PARAMETERS STATISTICAL ANALYSIS SHEET

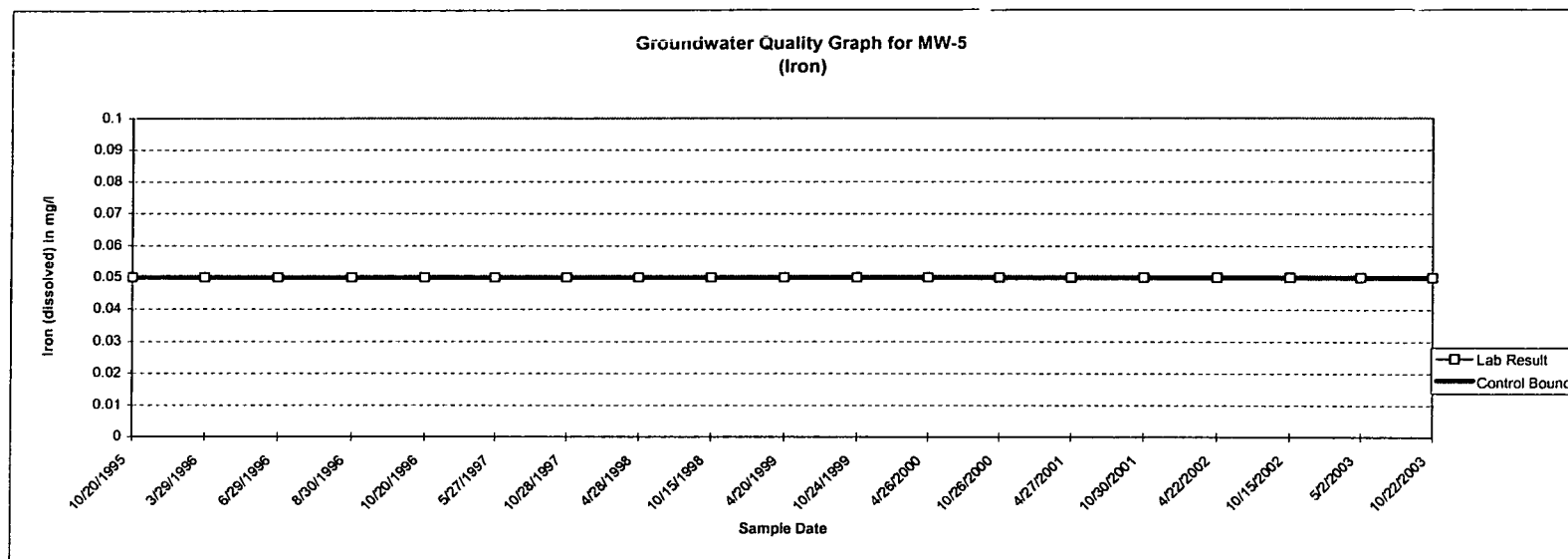


NOTE:

- 1) Results from Monitoring Well MW-5 were used to compute control limits - considered up gradient well
- 2) A lower control limit of zero (0) was used for those parameters in which a negative lower control limit was calculated.
- 3) One-half of the MDL was graphed for parameters reported at concentrations below their respective MDL.

ANALYSIS SHEET MW-5
MONONA COUNTY LANDFILL
GROUNDWATER SAMPLING AND ANALYSIS
PROJECT No. 40915034

SEMI-ANNUAL AND ANNUAL ROUTINE PARAMETERS STATISTICAL ANALYSIS SHEET

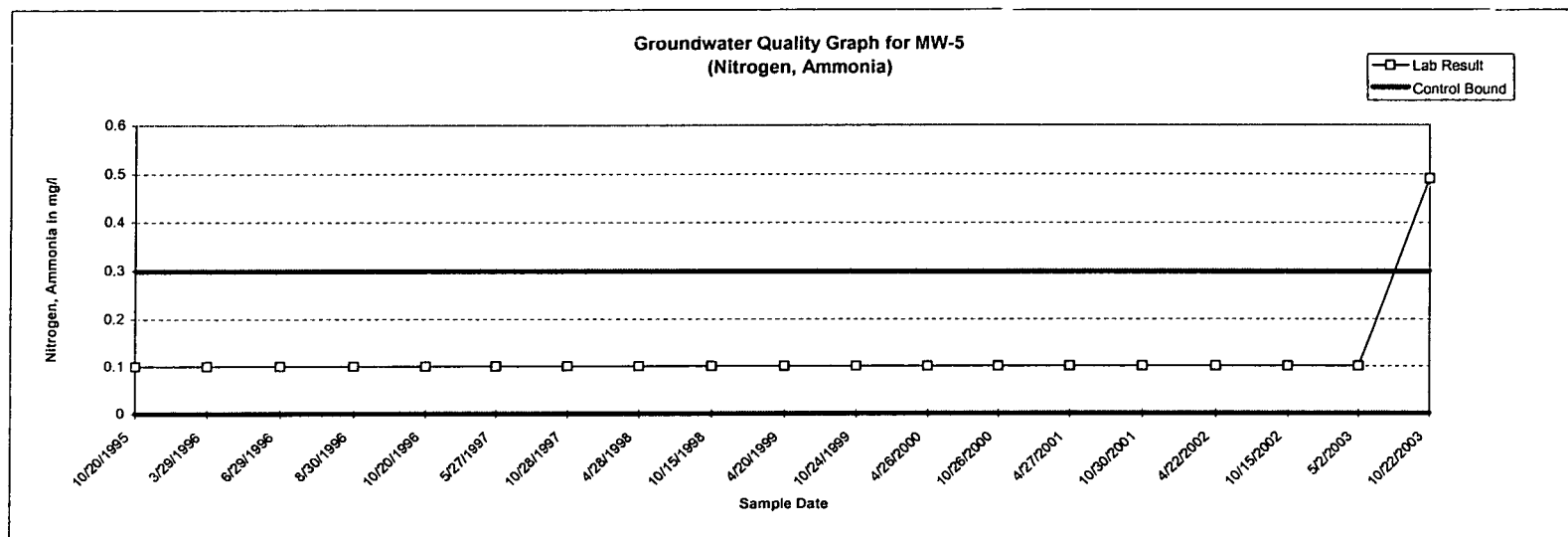


- NOTE:
- 1) Results from Monitoring Well MW-5 were used to compute control limits - considered an up-gradient well.
 - 2) The same non-detectable concentration results for MW-5 resulted in a single control bound (i.e. there was no deviation from the mean of the data).
 - 3) One-half of the MDL was graphed for parameters reported at concentrations below their respective MDL.

ANALYSIS SHEET MW-5

MONONA COUNTY LANDFILL GROUNDWATER SAMPLING AND ANALYSIS PROJECT No. 40915034

SEMI-ANNUAL AND ANNUAL ROUTINE PARAMETERS STATISTICAL ANALYSIS SHEET



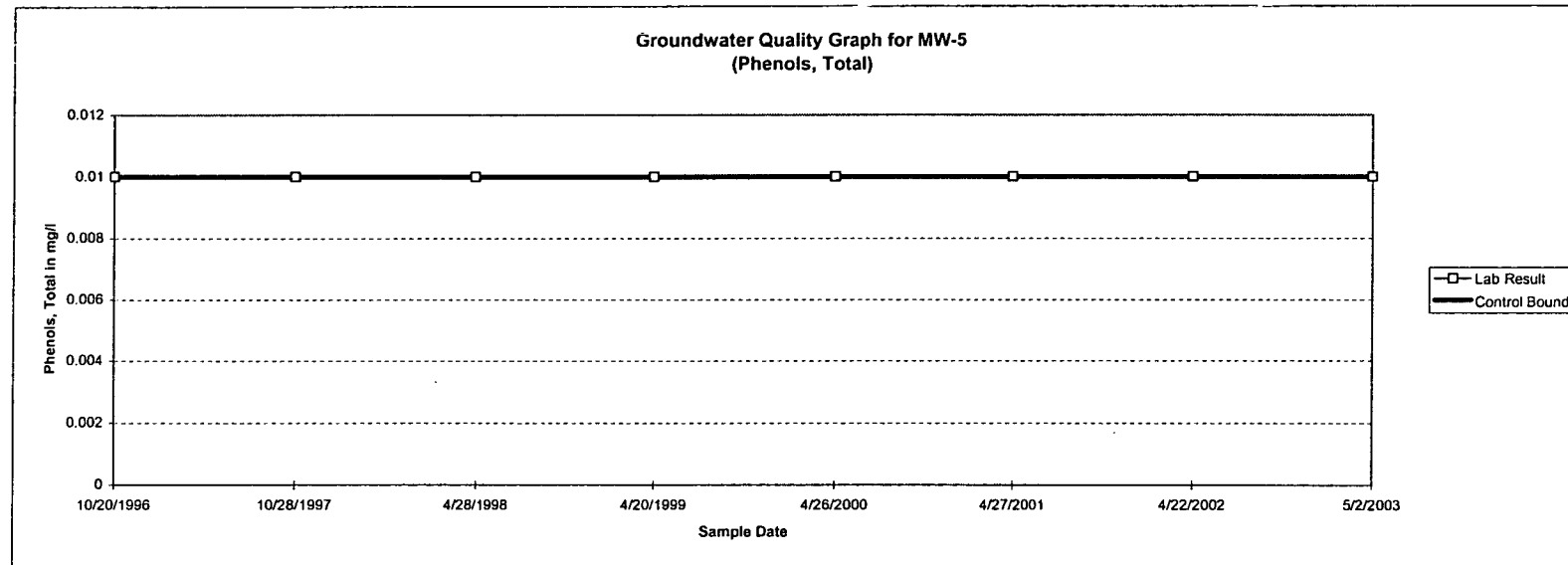
NOTE:

- 1) Results from Monitoring Well MW-5 were used to compute control limits - considered an up-gradient well.
- 2) A lower control limit of zero (0) was used for those parameters in which a negative lower control limit was calculated.
- 3) One-half of the MDL was graphed for parameters reported at concentrations below their respective MDL.

ANALYSIS SHEET MW-5

MONONA COUNTY LANDFILL
GROUNDWATER SAMPLING AND ANALYSIS
PROJECT No. 40915034

SEMI-ANNUAL AND ANNUAL ROUTINE PARAMETERS STATISTICAL ANALYSIS SHEET



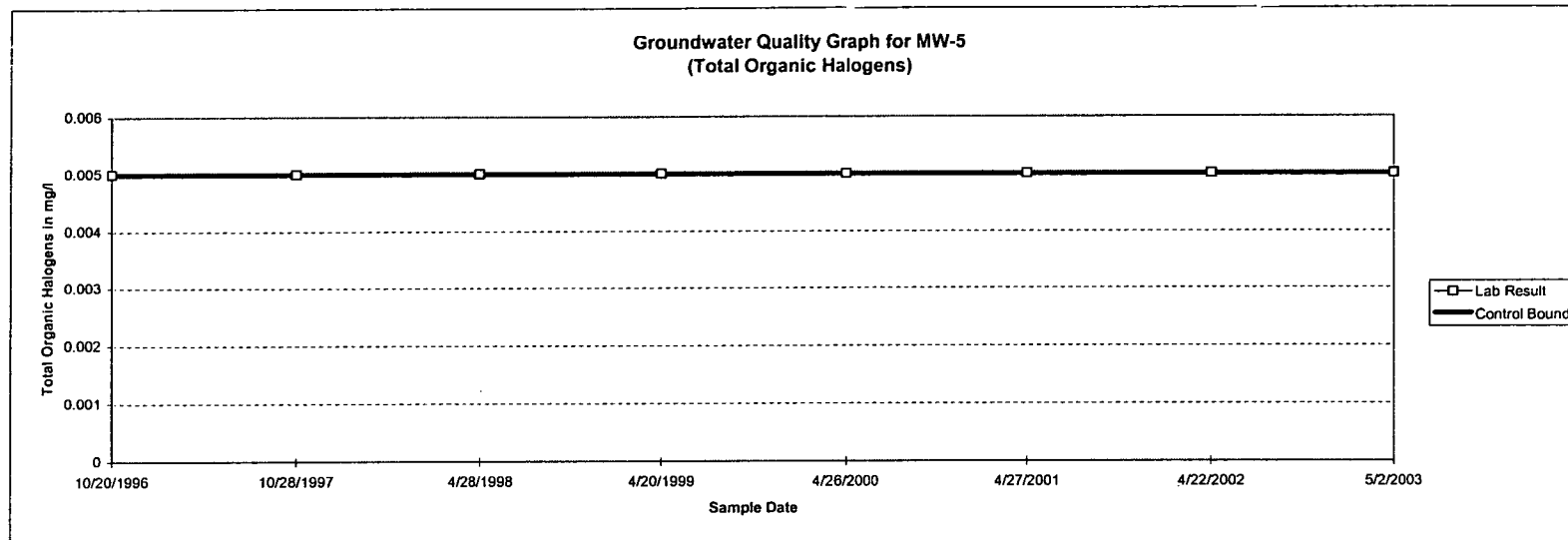
NOTE:

- 1) Results from Monitoring Well MW-5 were used to compute control limits - considered an up-gradient well.
- 2) The same non-detectable concentration results for MW-5 resulted in a single control bound (i.e. there was no deviation from the mean of the data).
- 3) One-half of the MDL was graphed for parameters reported at concentrations below their respective MDL.

ANALYSIS SHEET MW-5

MONONA COUNTY LANDFILL
GROUNDWATER SAMPLING AND ANALYSIS
PROJECT No. 40915034

SEMI-ANNUAL AND ANNUAL ROUTINE PARAMETERS STATISTICAL ANALYSIS SHEET



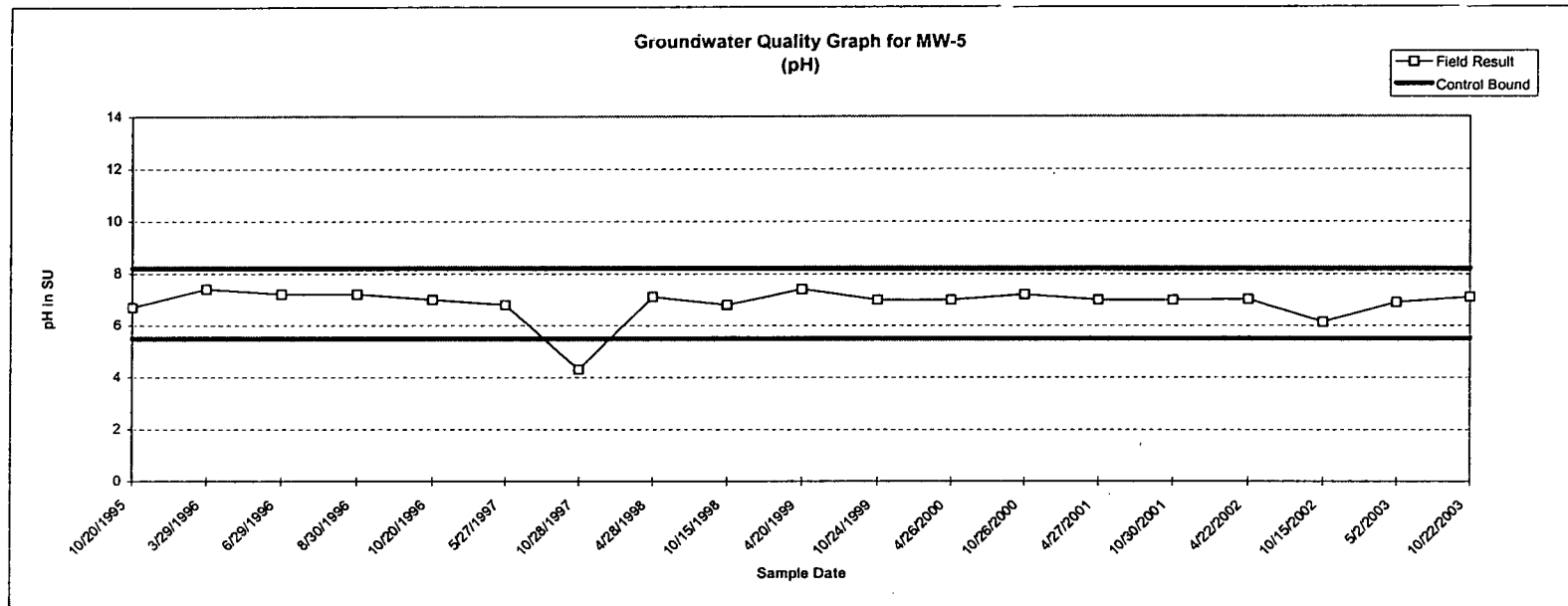
NOTE:

- 1) Results from Monitoring Well MW-5 were used to compute control limits - considered an up-gradient well.
- 2) The same non-detectable concentration results for MW-5 resulted in a single control bound (i.e. there was no deviation from the mean of the data).
- 3) One-half of the MDL was graphed for parameters reported at concentrations below their respective MDL.

ANALYSIS SHEET MW-5

MONONA COUNTY LANDFILL GROUNDWATER SAMPLING AND ANALYSIS PROJECT No. 40915034

SEMI-ANNUAL AND ANNUAL ROUTINE PARAMETERS STATISTICAL ANALYSIS SHEET



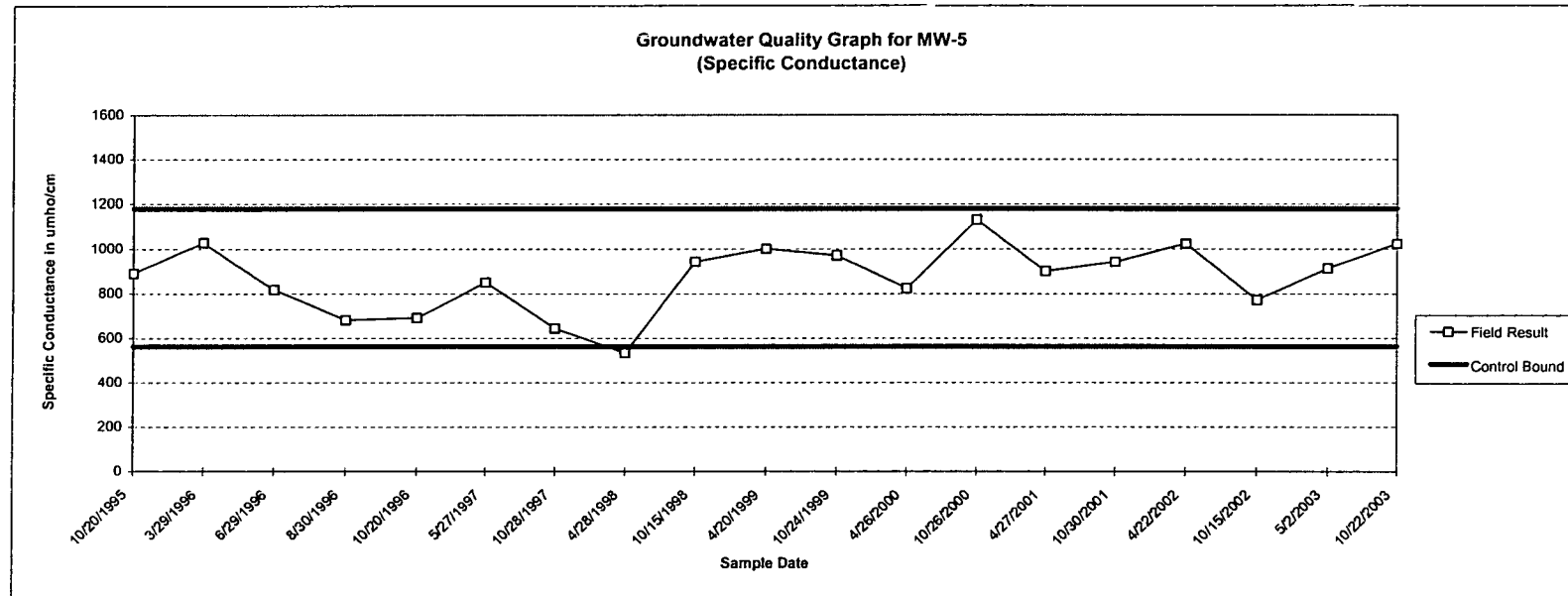
NOTE:

- 1) Results from Monitoring Well MW-5 were used to compute control limits - considered an up-gradient well.

ANALYSIS SHEET MW-5

MONONA COUNTY LANDFILL GROUNDWATER SAMPLING AND ANALYSIS PROJECT No. 40915034

SEMI-ANNUAL AND ANNUAL ROUTINE PARAMETERS STATISTICAL ANALYSIS SHEET



NOTE:

- 1) Results from Monitoring Well MW-5 were used to compute control limits - considered an up-gradient well.

ANALYSIS SHEET MW-4

**MONONA COUNTY LANDFILL
GROUNDWATER SAMPLING AND ANALYSIS
PROJECT No. 40915034**

SEMI-ANNUAL AND ANNUAL ROUTINE PARAMETERS STATISTICAL ANALYSIS SHEET

SAMPLE LOCATION NO. **MW-4** (Down-gradient)ANALYSIS PERFORMED BY: **TEST AMERICA INC.**SAMPLED BY: **TERRACON**

PARAMETER	Statistical Considerations				SAMPLE DATE												
	Upper Control Limit via MW-5	Lower Control Limit via MW-5	MW-4 Standard Deviation	MW-4 Mean	10/20/1995	3/29/1996	6/29/1996	8/30/1996	10/20/1996	5/27/1997	10/28/1997	4/28/1998	10/15/1998	4/20/1999	10/24/1999	4/26/2000	10/26/2000
Laboratory Parameters																	
Chloride (mg/l)	18.1	2.05	0.00	2.50	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5
Chemical Oxygen Demand (mg/l)	14.4	0.00	1.72	2.89	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5
Iron, dissolved (mg/l)	0.05	0.05	0.02	0.05	0.05	0.05	0.13	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
Nitrogen, Ammonia (mg/l)	0.30	0.00	0.13	0.13	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Phenols, total (mg/l)	0.01	0.01	0.00	0.01	-	-	-	-	0.01	-	0.01	0.01	-	0.01	-	0.01	-
Total Organic Halogens (mg/l)	0.005	0.005	0.00	0.01	-	-	-	-	0.005	-	0.005	0.005	-	0.005	-	0.005	-
Field Parameters																	
pH (SU)	8.21	5.50	0.39	7.00	7.6	7.7	7.30	7.1	7.1	6.8	7.4	6.8	6.8	6.6	6.8	7.1	7.2
Specific Conductance (umho/cm)	1179	564	158	754	764	823	811	512	540	630	554	570	793	900	871	735	1118

NOTE:

- 1) Results shown in bold represent one-half of the laboratory detection limit (MDL) [for parameters reported below the MDL].
- 2) One-half of the MDL was used for parameters reported at concentrations below their respective MDL to compute their respective control limits (mean +/- two times the standard deviation for the chemicals observed at MW-5).
- 3) One-half of the MDL was graphed for parameters reported at concentrations below their respective MDL.
- 4) A lower control limit of zero (0) was used for those parameters in which a negative lower control limit was calculated.
- 5) Results from Monitoring Well MW-5 were used to compute control limits - considered up-gradient well

ANALYSIS SHEET MW-4

MONONA COUNTY LANDFILL GROUNDWATER SAMPLING AND ANALYSIS PROJECT No. 40915034

SEMI-ANNUAL AND ANNUAL ROUTINE PARAMETERS STATISTICAL ANALYSIS SHEET

SAMPLE LOCATION NO. **MW-4** (Down-gradient)

ANALYSIS PERFORMED BY: **TEST AMERICA INC.**

SAMPLED BY: **TERRACON**

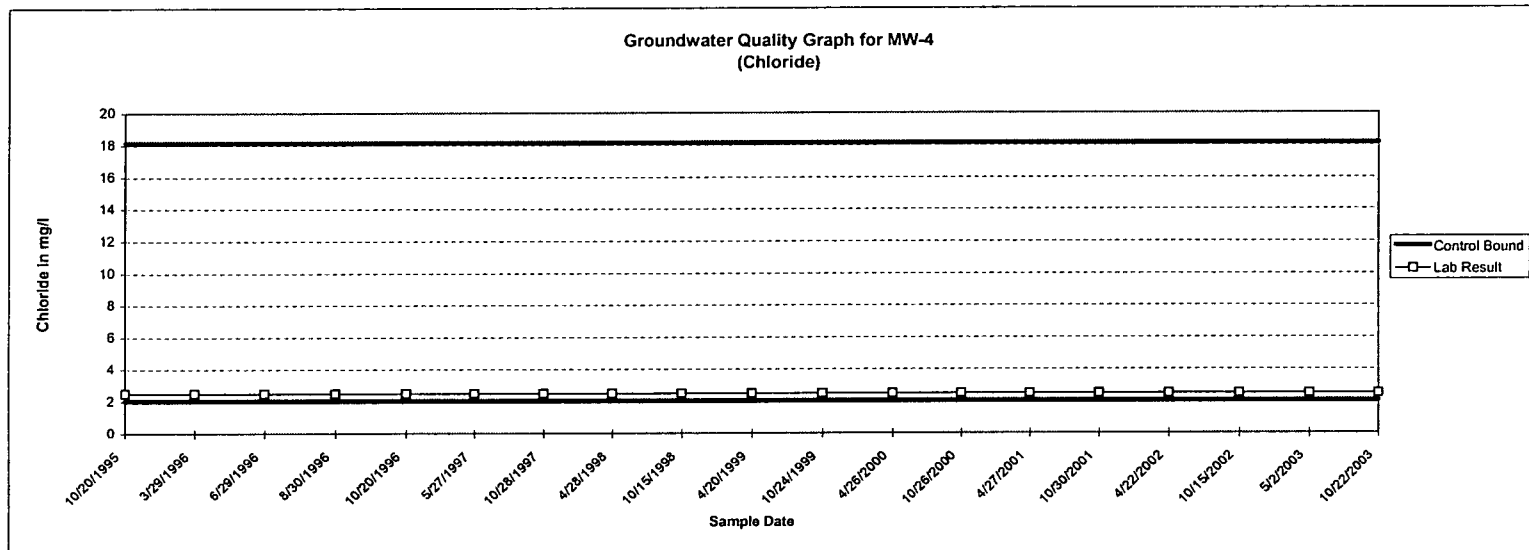
PARAMETER	Statistical Considerations				SAMPLE DATE					
	Upper Control Limit via MW-5	Lower Control Limit via MW-5	MW-4 Standard Deviation	MW-4 Mean	4/27/2001	10/30/2001	4/22/2002	10/15/2002	5/2/2003	10/22/2003
Laboratory Parameters										
Chloride (mg/l)	18.1	2.05	0.00	2.50	2.5	2.5	2.5	2.5	2.5	2.5
Chemical Oxygen Demand (mg/l)	14.4	0.00	1.72	2.89	2.5	2.5	2.5	2.5	10	2.5
Iron, dissolved (mg/l)	0.05	0.05	0.02	0.05	0.05	0.05	0.05	0.05	0.05	0.05
Nitrogen, Ammonia (mg/l)	0.30	0.00	0.13	0.13	0.1	0.1	0.1	0.1	0.2	0.66
Phenols, total (mg/l)	0.01	0.01	0.00	0.01	0.01	-	0.01	-	0.01	-
Total Organic Halogens (mg/l)	0.005	0.005	0.00	0.01	0.005	-	0.005	-	0.005	-
Field Parameters										
pH (SU)	8.21	5.50	0.39	7.00	7.0	7.1	6.8	6.0	6.8	7.0
Specific Conductance (umho/cm)	1179	564	158	754	780	782	986	607	778	772

NOTE:

- 1) Results shown in bold represent one-half of the laboratory detection limit (MDL) [for parameters reported below the MDL].
- 2) One-half of the MDL was used for parameters reported at concentrations below their respective MDL to compute their respective control limits (mean +/- two times the standard deviation for the chemicals observed at MW-5).
- 3) One-half of the MDL was graphed for parameters reported at concentrations below their respective MDL.
- 4) A lower control limit of zero (0) was used for those parameters in which a negative lower control limit was calculated.
- 5) Results from Monitoring Well MW-5 were used to compute control limits - considered up-gradient well

ANALYSIS SHEET MW-4
MONONA COUNTY LANDFILL
GROUNDWATER SAMPLING AND ANALYSIS
PROJECT No. 40915034

SEMI-ANNUAL AND ANNUAL ROUTINE PARAMETERS STATISTICAL ANALYSIS SHEET



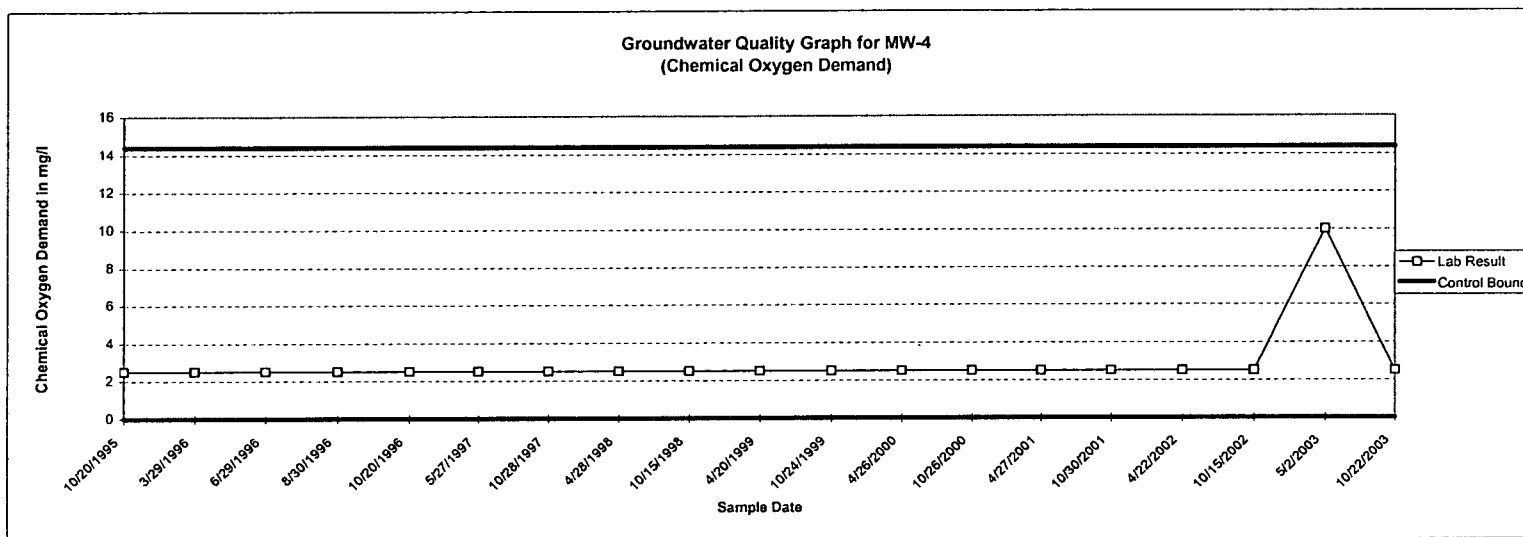
NOTE:

- 1) Results from Monitoring Well MW-5 were used to compute control limits - considered up-gradient well
- 2) One-half of the MDL was graphed for parameters reported at concentrations below their respective MDL.

ANALYSIS SHEET MW-4

MONONA COUNTY LANDFILL GROUNDWATER SAMPLING AND ANALYSIS PROJECT No. 40915034

SEMI-ANNUAL AND ANNUAL ROUTINE PARAMETERS STATISTICAL ANALYSIS SHEET

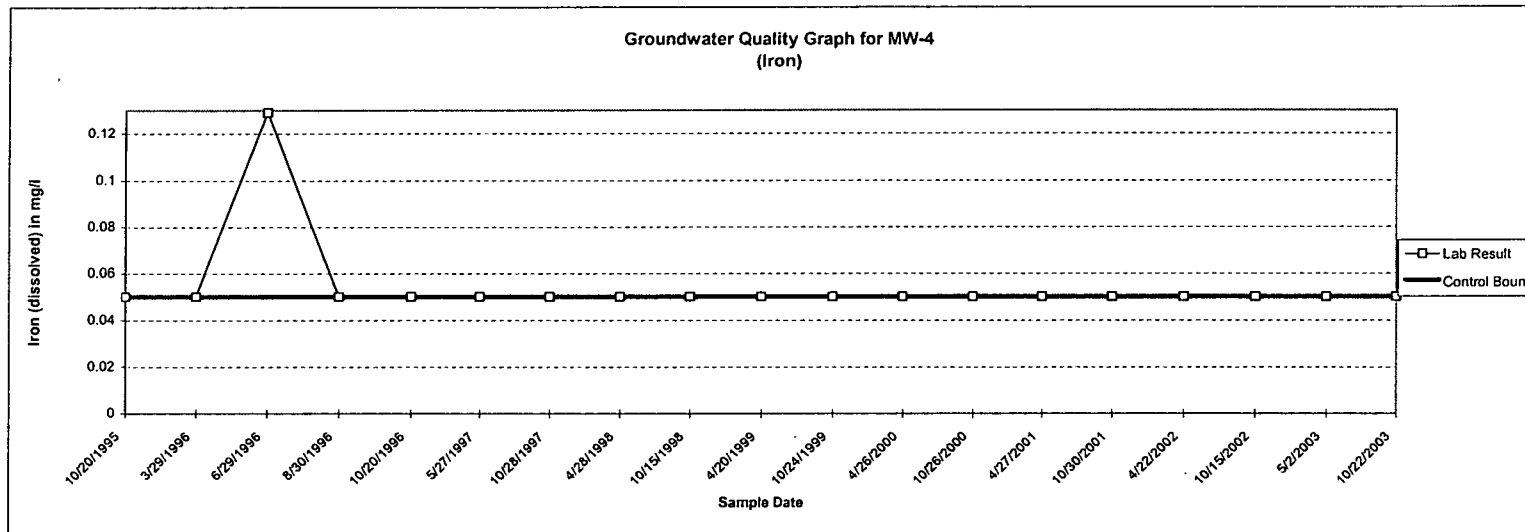


NOTE:

- 1) Results from Monitoring Well MW-5 were used to compute control limits - considered up gradient well
- 2) A lower control limit of zero (0) was used for those parameters in which a negative lower control limit was calculated.
- 3) One-half of the MDL was graphed for parameters reported at concentrations below their respective MDL.

ANALYSIS SHEET MW-4
MONONA COUNTY LANDFILL
GROUNDWATER SAMPLING AND ANALYSIS
PROJECT No. 40915034

SEMI-ANNUAL AND ANNUAL ROUTINE PARAMETERS STATISTICAL ANALYSIS SHEET



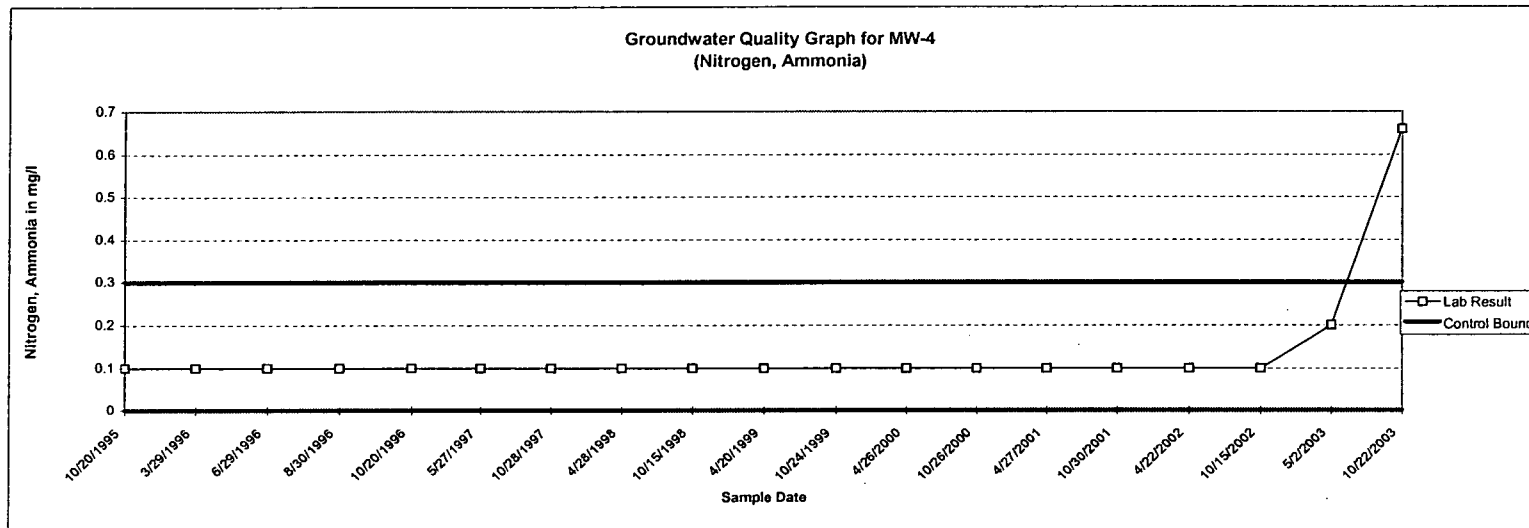
NOTE:

- 1) Results from Monitoring Well MW-5 were used to compute control limits - considered an up-gradient well.
- 2) The same non-detectable concentration results for MW-5 resulted in a single control bound (i.e. there was no deviation from the mean of the data).
- 3) One-half of the MDL was graphed for parameters reported at concentrations below their respective MDL.

ANALYSIS SHEET MW-4

MONONA COUNTY LANDFILL GROUNDWATER SAMPLING AND ANALYSIS PROJECT No. 40915034

SEMI-ANNUAL AND ANNUAL ROUTINE PARAMETERS STATISTICAL ANALYSIS SHEET

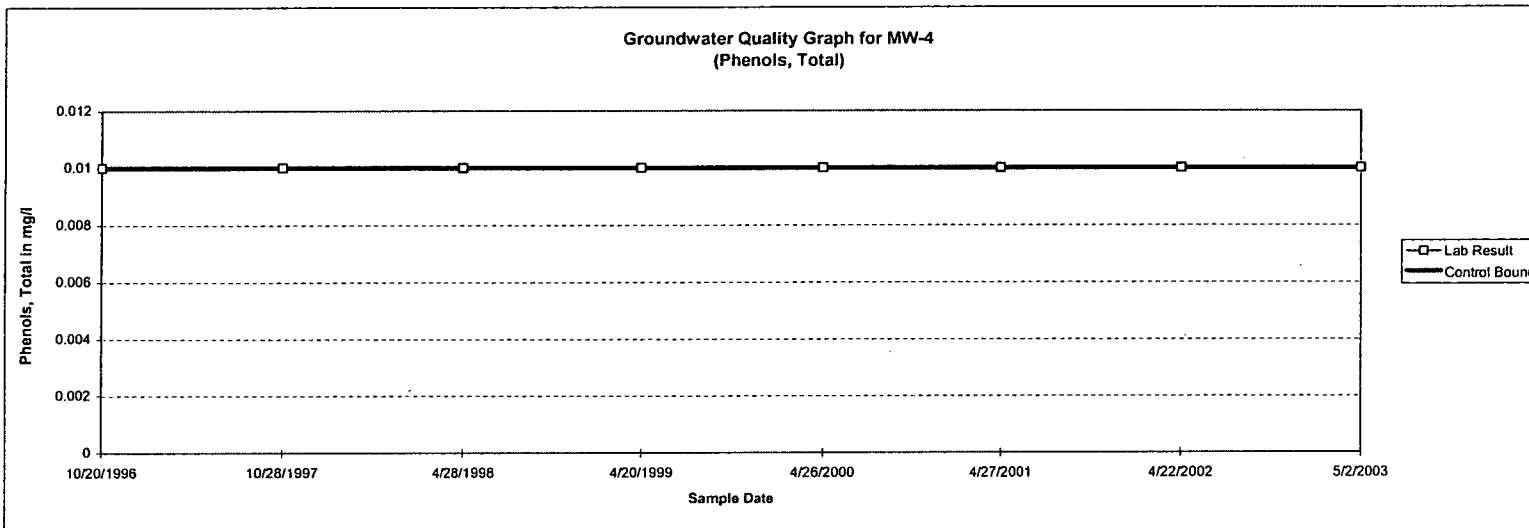


NOTE:

- 1) Results from Monitoring Well MW-5 were used to compute control limits - considered an up-gradient well.
- 2) A lower control limit of zero (0) was used for those parameters in which a negative lower control limit was calculated.
- 3) One-half of the MDL was graphed for parameters reported at concentrations below their respective MDL.

ANALYSIS SHEET MW-4
MONONA COUNTY LANDFILL
GROUNDWATER SAMPLING AND ANALYSIS
PROJECT No. 40915034

SEMI-ANNUAL AND ANNUAL ROUTINE PARAMETERS STATISTICAL ANALYSIS SHEET

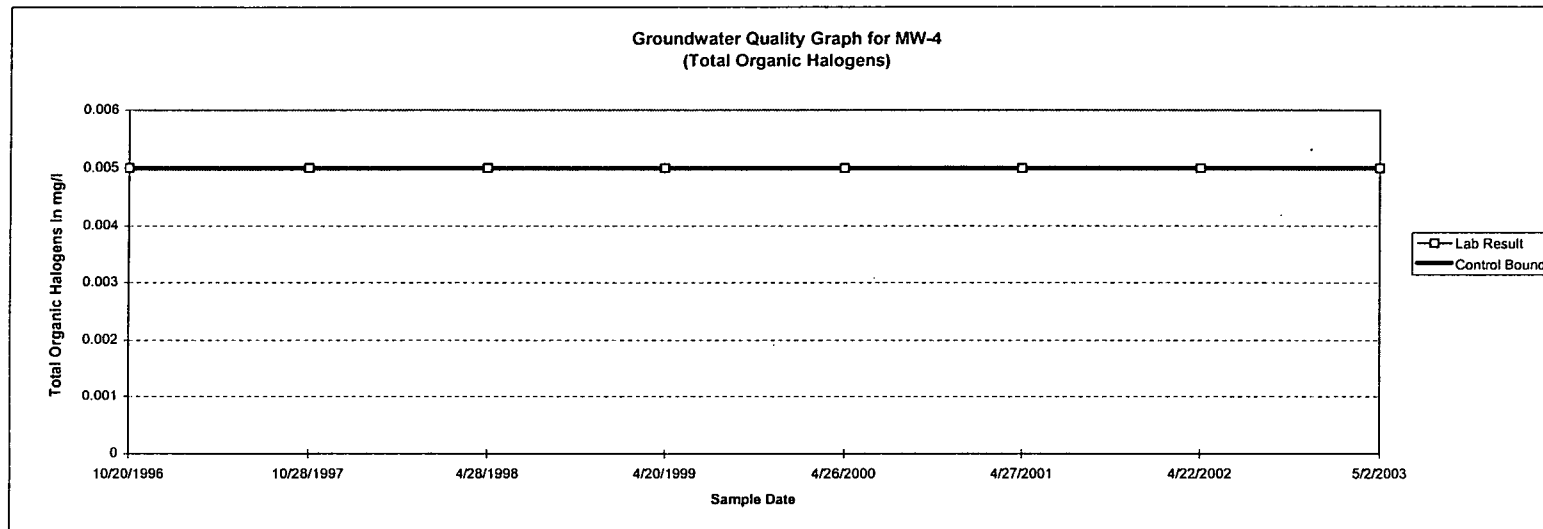


NOTE:

- 1) Results from Monitoring Well MW-5 were used to compute control limits - considered an up-gradient well.
- 2) The same non-detectable concentration results for MW-5 resulted in a single control bound (i.e. there was no deviation from the mean of the data).
- 3) One-half of the MDL was graphed for parameters reported at concentrations below their respective MDL.

ANALYSIS SHEET MW-4
MONONA COUNTY LANDFILL
GROUNDWATER SAMPLING AND ANALYSIS
PROJECT No. 40915034

SEMI-ANNUAL AND ANNUAL ROUTINE PARAMETERS STATISTICAL ANALYSIS SHEET

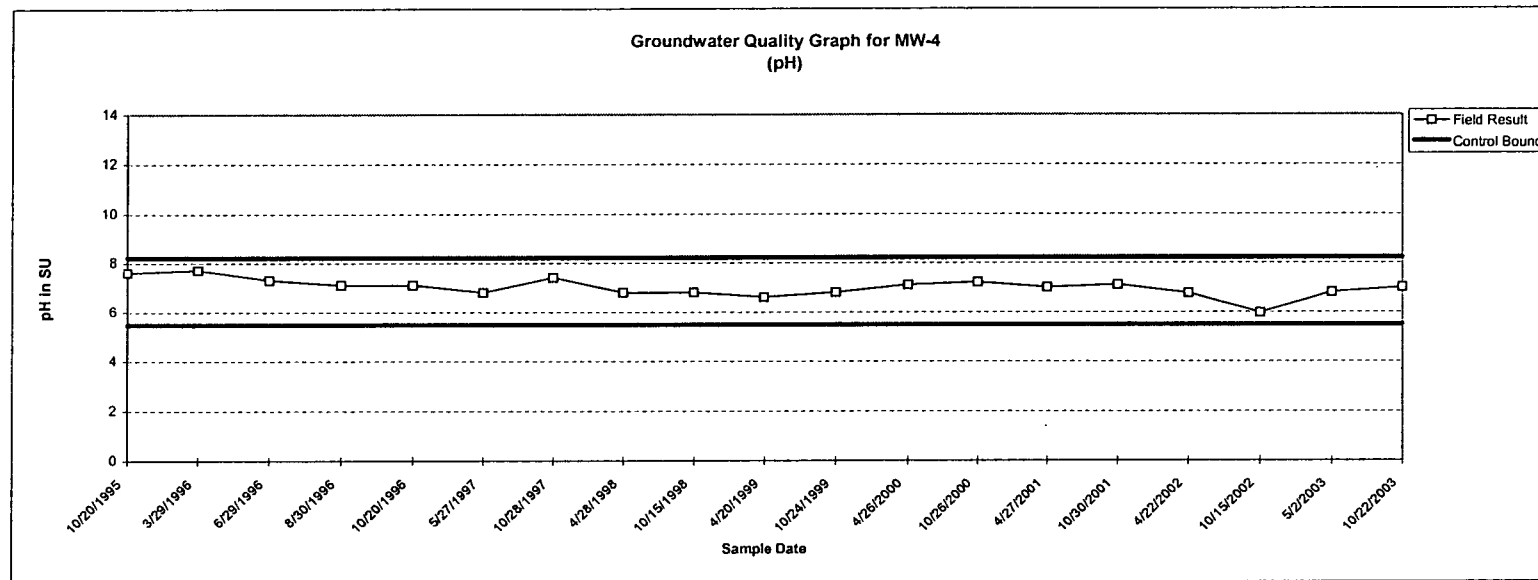


NOTE:

- 1) Results from Monitoring Well MW-5 were used to compute control limits - considered an up-gradient well.
- 2) The same non-detectable concentration results for MW-5 resulted in a single control bound (i.e. there was no deviation from the mean of the data).
- 3) One-half of the MDL was graphed for parameters reported at concentrations below their respective MDL.

ANALYSIS SHEET MW-4
MONONA COUNTY LANDFILL
GROUNDWATER SAMPLING AND ANALYSIS
PROJECT No. 40915034

SEMI-ANNUAL AND ANNUAL ROUTINE PARAMETERS STATISTICAL ANALYSIS SHEET



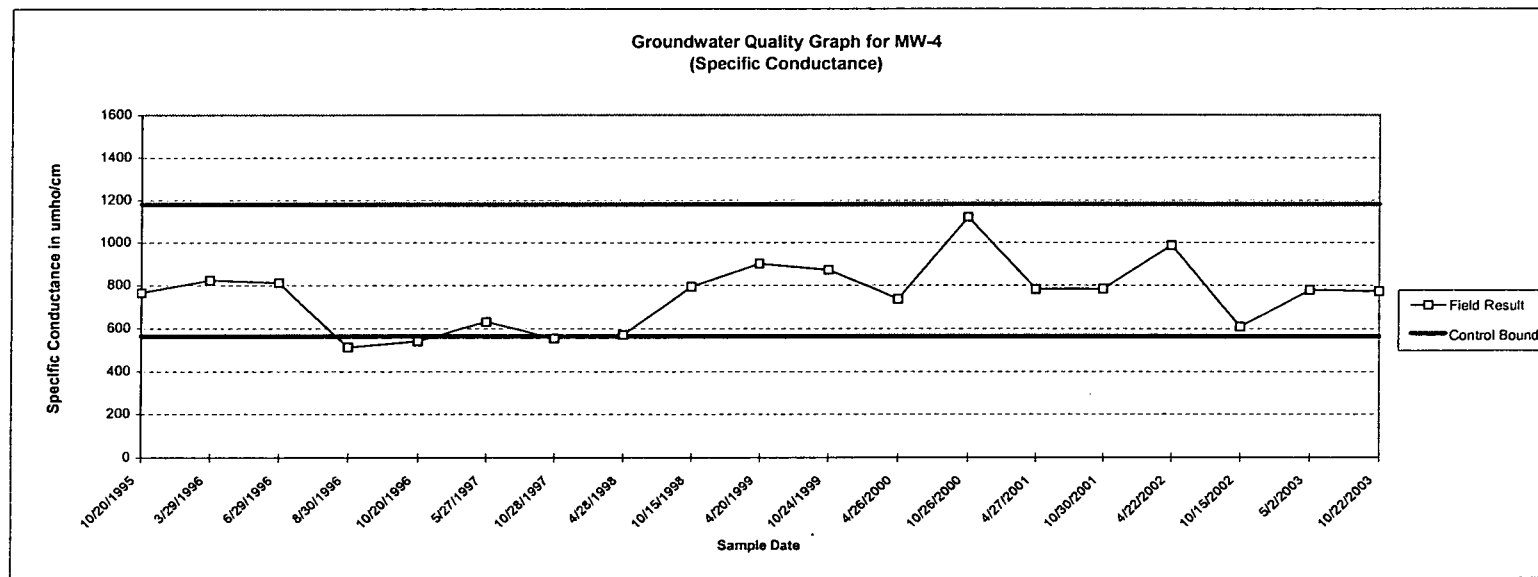
NOTE:

- 1) Results from Monitoring Well MW-5 were used to compute control limits - considered an up-gradient well.

ANALYSIS SHEET MW-4

MONONA COUNTY LANDFILL
GROUNDWATER SAMPLING AND ANALYSIS
PROJECT No. 40915034

SEMI-ANNUAL AND ANNUAL ROUTINE PARAMETERS STATISTICAL ANALYSIS SHEET



NOTE:

- 1) Results from Monitoring Well MW-5 were used to compute control limits - considered an up-gradient well.

ANALYSIS SHEET MW-3

**MONONA COUNTY LANDFILL
GROUNDWATER SAMPLING AND ANALYSIS
PROJECT No. 40915034**

SEMI-ANNUAL AND ANNUAL ROUTINE PARAMETERS STATISTICAL ANALYSIS SHEET

SAMPLE LOCATION NO. **MW-3 (Down-gradient)**ANALYSIS PERFORMED BY: **TEST AMERICA INC.**SAMPLED BY: **TERRACON**

PARAMETER	Statistical Considerations				SAMPLE DATE												
	Upper Control Limit via MW-5	Lower Control Limit via MW-5	MW-3 Standard Deviation	MW-3 Mean	10/20/1995	3/29/1996	6/29/1996	8/30/1996	10/20/1996	5/27/1997	10/28/1997	4/28/1998	10/15/1998	4/20/1999	10/24/1999	4/26/2000	10/26/2000
Laboratory Parameters																	
Chloride (mg/l)	18.1	2.05	0.57	2.63	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5
Chemical Oxygen Demand (mg/l)	14.4	0.00	0.00	2.50	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5
Iron, dissolved (mg/l)	0.05	0.05	0.00	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
Nitrogen, Ammonia (mg/l)	0.30	0.00	0.03	0.11	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.22	0.1	0.1	0.1	0.1
Phenols, total (mg/l)	0.01	0.01	0.00	0.01	-	-	-	-	0.01	-	0.01	0.01	-	0.01	-	0.01	-
Total Organic Halogens (mg/l)	0.005	0.005	0.00	0.01	-	-	-	-	0.005	-	0.005	0.005	-	0.005	-	0.005	-
Field Parameters																	
pH (SU)	8.21	5.50	0.33	7.04	6.9	7.9	7.20	7.1	7.1	7.0	7.0	7.1	6.7	7.4	6.9	7.1	7.2
Specific Conductance (umho/cm)	1179	564	124	772	883	957	760	670	627	711	564	612	832	900	801	714	1022

NOTE:

- 1) Results shown in bold represent one-half of the laboratory detection limit (MDL) [for parameters reported below the MDL].
- 2) One-half of the MDL was used for parameters reported at concentrations below their respective MDL to compute their respective control limits (mean +/- two times the standard deviation for the chemicals observed at MW-5).
- 3) One-half of the MDL was graphed for parameters reported at concentrations below their respective MDL.
- 4) A lower control limit of zero (0) was used for those parameters in which a negative lower control limit was calculated.
- 5) Results from Monitoring Well MW-5 were used to compute control limits - considered up-gradient well

ANALYSIS SHEET MW-3

**MONONA COUNTY LANDFILL
GROUNDWATER SAMPLING AND ANALYSIS
PROJECT No. 40915034**

SEMI-ANNUAL AND ANNUAL ROUTINE PARAMETERS STATISTICAL ANALYSIS SHEET

SAMPLE LOCATION NO. **MW-3 (Down-gradient)**ANALYSIS PERFORMED BY: **TEST AMERICA INC.**SAMPLED BY: **TERRACON**

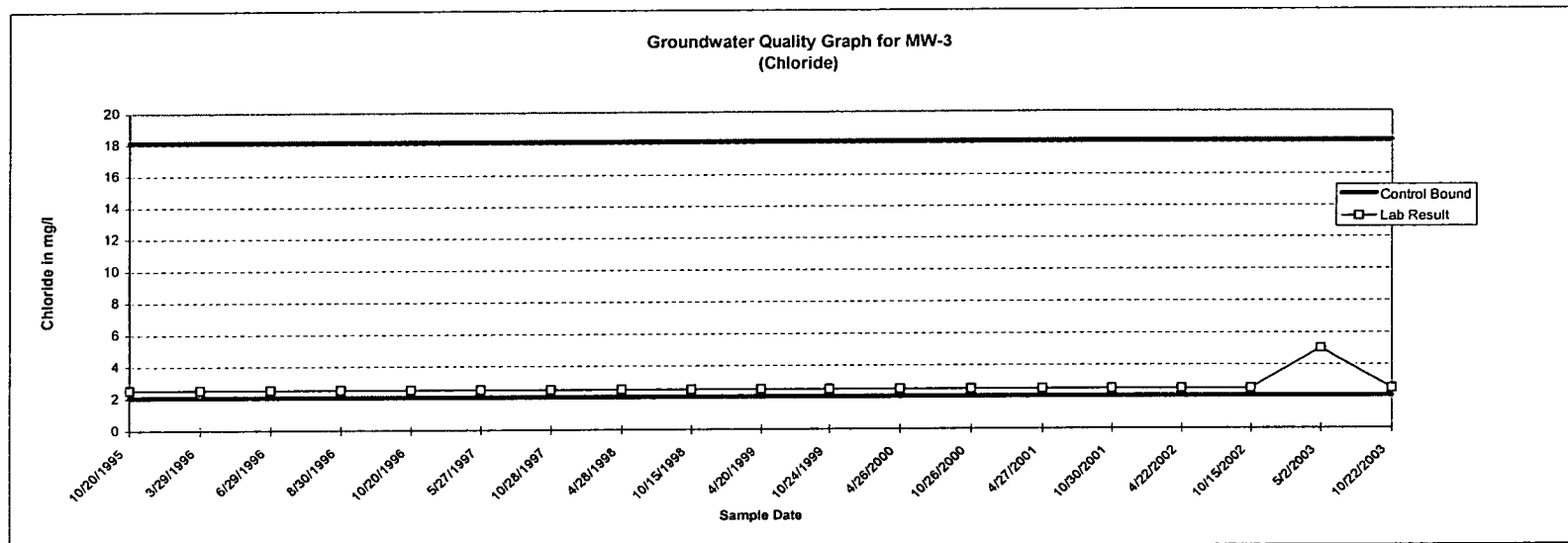
PARAMETER	Statistical Considerations				SAMPLE DATE					
	Upper Control Limit via MW-5	Lower Control Limit via MW-5	MW-3 Standard Deviation	MW-3 Mean	4/27/2001	10/30/2001	4/22/2002	10/15/2002	5/2/2003	10/22/2003
Laboratory Parameters										
Chloride (mg/l)	18.1	2.05	0.57	2.63	2.5	2.5	2.5	2.5	5.0	2.5
Chemical Oxygen Demand (mg/l)	14.4	0.00	0.00	2.50	2.5	2.5	2.5	2.5	2.5	2.5
Iron, dissolved (mg/l)	0.05	0.05	0.00	0.05	0.05	0.05	0.05	0.05	0.05	0.05
Nitrogen, Ammonia (mg/l)	0.30	0.00	0.03	0.11	0.1	0.1	0.1	0.1	0.1	0.1
Phenols, total (mg/l)	0.01	0.01	0.00	0.01	0.01	-	0.01	-	0.01	-
Total Organic Halogens (mg/l)	0.005	0.005	0.00	0.01	0.005	-	0.005	-	0.005	-
Field Parameters										
pH (SU)	8.21	5.50	0.33	7.04	6.9	7.1	7.0	6.1	7.0	7.0
Specific Conductance (umho/cm)	1179	564	124	772	752	843	808	602	805	811

NOTE:

- 1) Results shown in bold represent one-half of the laboratory detection limit (MDL) [for parameters reported below the MDL].
- 2) One-half of the MDL was used for parameters reported at concentrations below their respective MDL to compute their respective control limits (mean +/- two times the standard deviation for the chemicals observed at MW-5).
- 3) One-half of the MDL was graphed for parameters reported at concentrations below their respective MDL.
- 4) A lower control limit of zero (0) was used for those parameters in which a negative lower control limit was calculated.
- 5) Results from Monitoring Well MW-5 were used to compute control limits - considered up-gradient well

ANALYSIS SHEET MW-3
MONONA COUNTY LANDFILL
GROUNDWATER SAMPLING AND ANALYSIS
PROJECT No. 40915034

SEMI-ANNUAL AND ANNUAL ROUTINE PARAMETERS STATISTICAL ANALYSIS SHEET



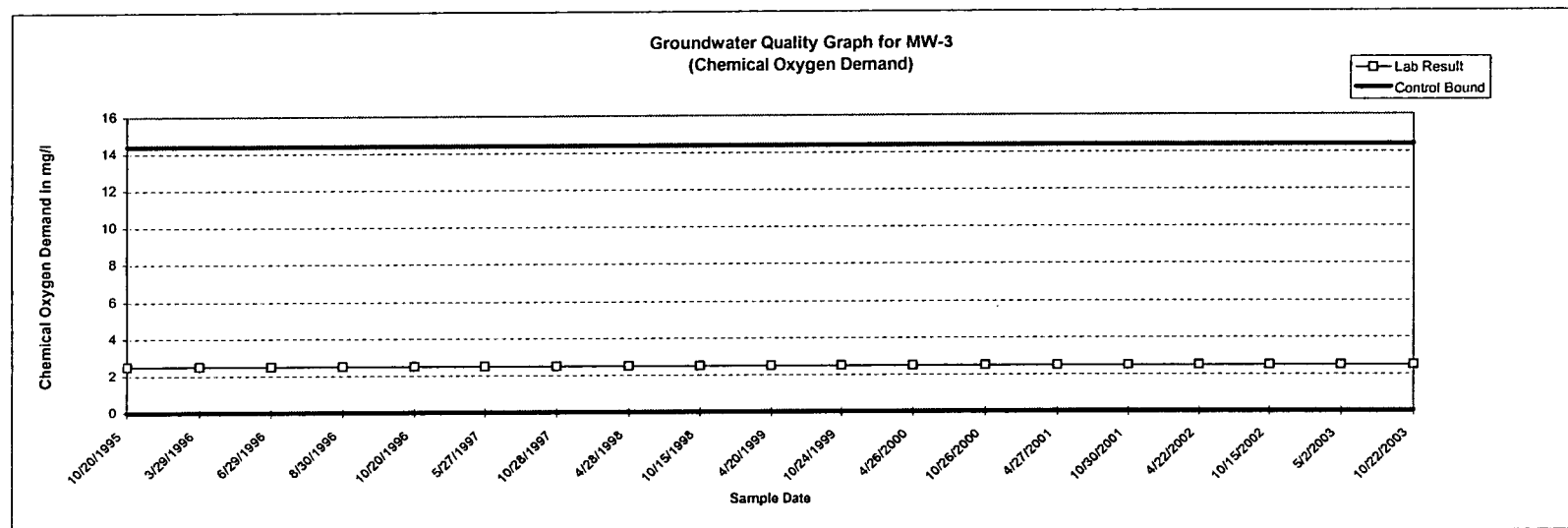
NOTE:

- 1) Results from Monitoring Well MW-5 were used to compute control limits - considered up-gradient well
- 2) One-half of the MDL was graphed for parameters reported at concentrations below their respective MDL.

ANALYSIS SHEET MW-3

MONONA COUNTY LANDFILL GROUNDWATER SAMPLING AND ANALYSIS PROJECT No. 40915034

SEMI-ANNUAL AND ANNUAL ROUTINE PARAMETERS STATISTICAL ANALYSIS SHEET

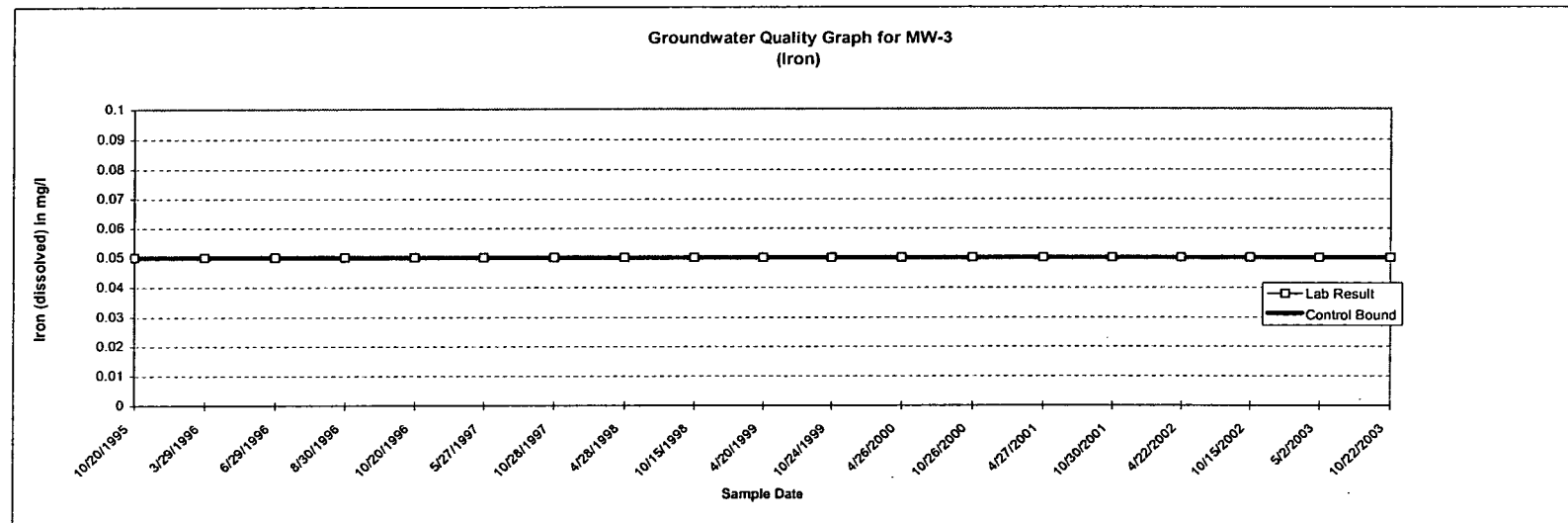


NOTE:

- 1) Results from Monitoring Well MW-5 were used to compute control limits - considered up gradient well
- 2) A lower control limit of zero (0) was used for those parameters in which a negative lower control limit was calculated.
- 3) One-half of the MDL was graphed for parameters reported at concentrations below their respective MDL.

ANALYSIS SHEET MW-3
MONONA COUNTY LANDFILL
GROUNDWATER SAMPLING AND ANALYSIS
PROJECT No. 40915034

SEMI-ANNUAL AND ANNUAL ROUTINE PARAMETERS STATISTICAL ANALYSIS SHEET

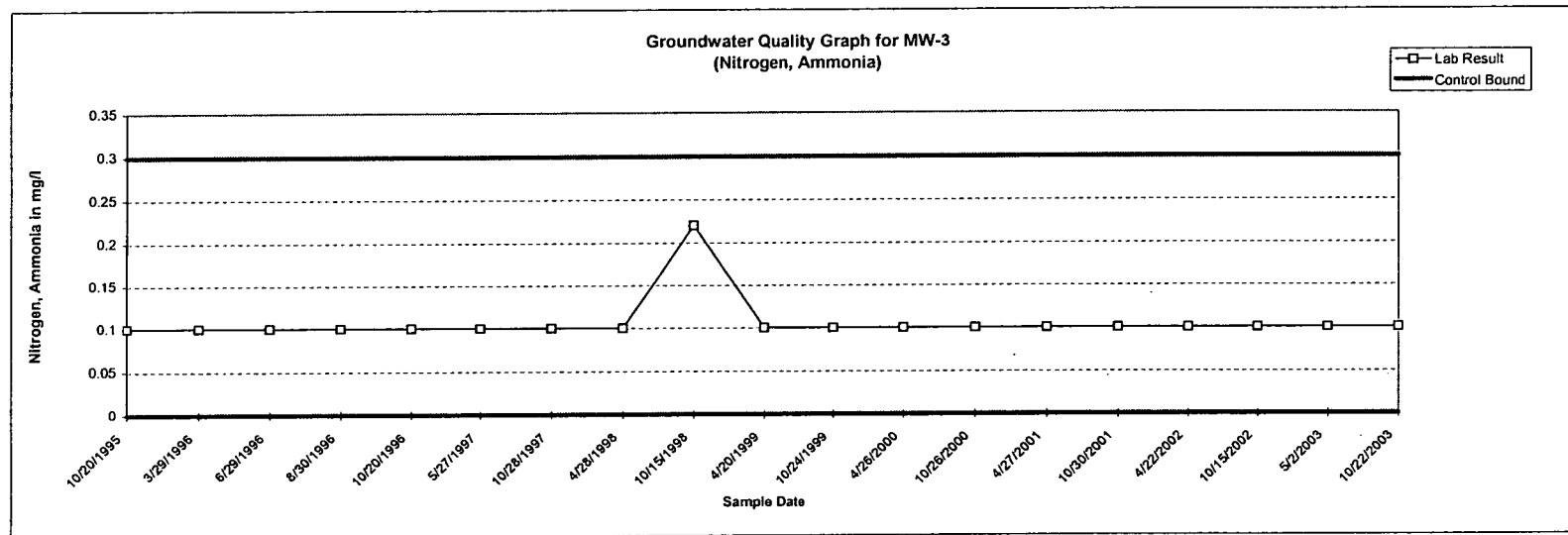


NOTE:

- 1) Results from Monitoring Well MW-5 were used to compute control limits - considered an up-gradient well.
- 2) The same non-detectable concentration results for MW-5 resulted in a single control bound (i.e. there was no deviation from the mean of the data).
- 3) One-half of the MDL was graphed for parameters reported at concentrations below their respective MDL.

ANALYSIS SHEET MW-3
MONONA COUNTY LANDFILL
GROUNDWATER SAMPLING AND ANALYSIS
PROJECT No. 40915034

SEMI-ANNUAL AND ANNUAL ROUTINE PARAMETERS STATISTICAL ANALYSIS SHEET

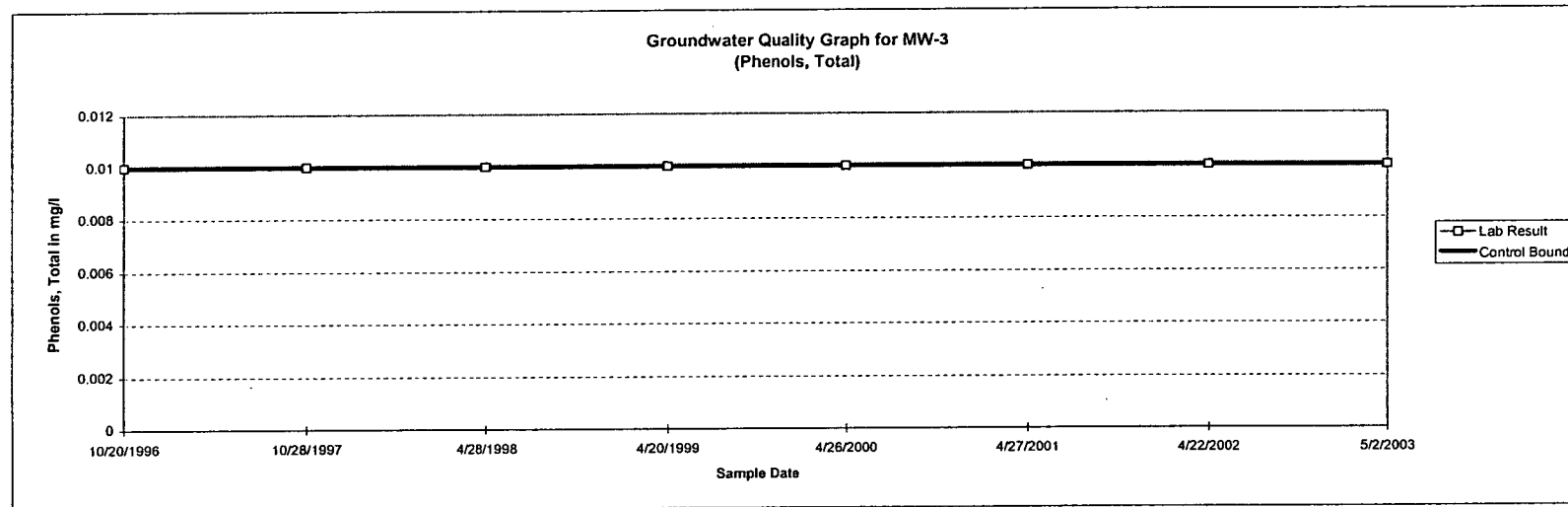


NOTE:

- 1) Results from Monitoring Well MW-5 were used to compute control limits - considered an up-gradient well.
- 2) A lower control limit of zero (0) was used for those parameters in which a negative lower control limit was calculated.
- 3) One-half of the MDL was graphed for parameters reported at concentrations below their respective MDL.

ANALYSIS SHEET MW-3
MONONA COUNTY LANDFILL
GROUNDWATER SAMPLING AND ANALYSIS
PROJECT No. 40915034

SEMI-ANNUAL AND ANNUAL ROUTINE PARAMETERS STATISTICAL ANALYSIS SHEET

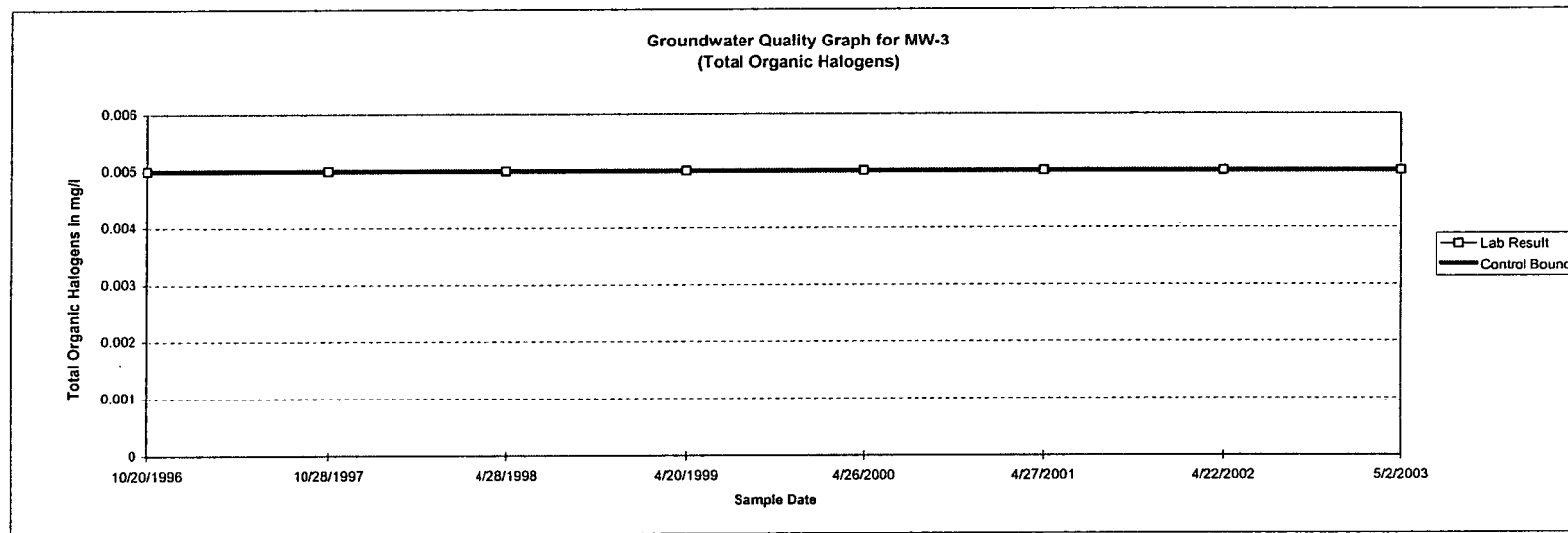


NOTE:

- 1) Results from Monitoring Well MW-5 were used to compute control limits - considered an up-gradient well.
- 2) The same non-detectable concentration results for MW-5 resulted in a single control bound (i.e. there was no deviation from the mean of the data).
- 3) One-half of the MDL was graphed for parameters reported at concentrations below their respective MDL.

ANALYSIS SHEET MW-3
MONONA COUNTY LANDFILL
GROUNDWATER SAMPLING AND ANALYSIS
PROJECT No. 40915034

SEMI-ANNUAL AND ANNUAL ROUTINE PARAMETERS STATISTICAL ANALYSIS SHEET

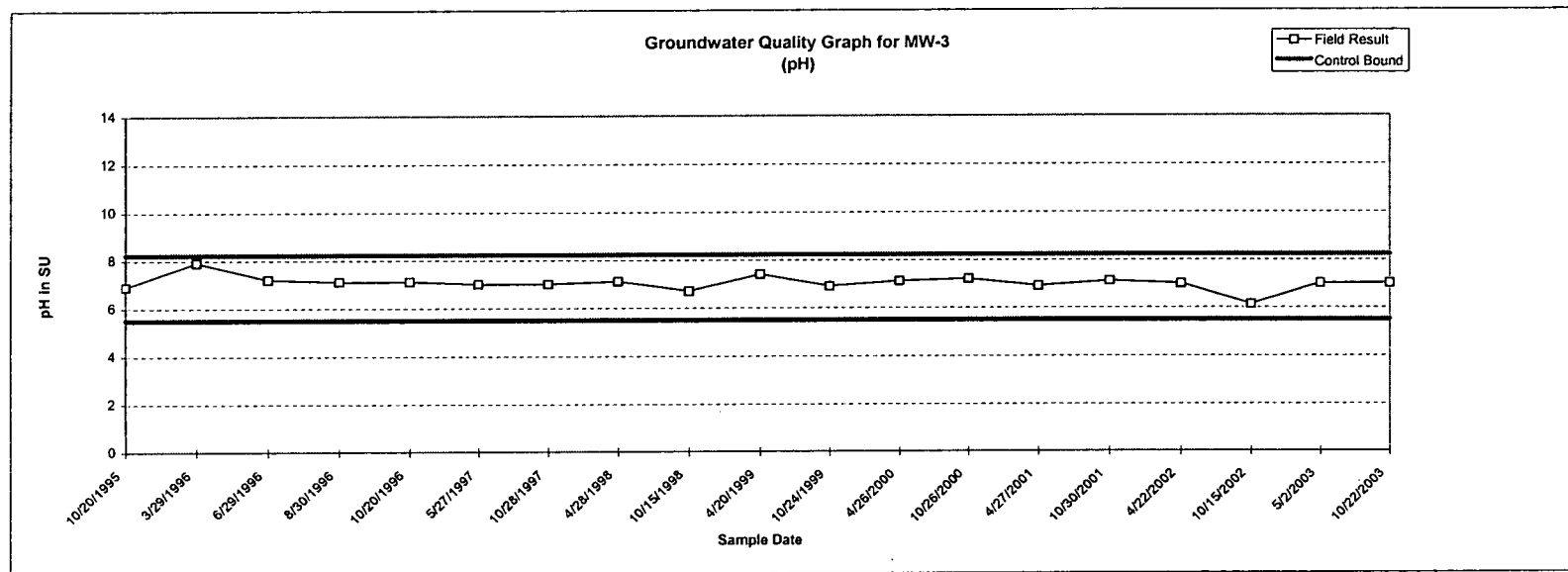


NOTE:

- 1) Results from Monitoring Well MW-5 were used to compute control limits - considered an up-gradient well.
- 2) The same non-detectable concentration results for MW-5 resulted in a single control bound (i.e. there was no deviation from the mean of the data).
- 3) One-half of the MDL was graphed for parameters reported at concentrations below their respective MDL.

ANALYSIS SHEET MW-3
 MONONA COUNTY LANDFILL
 GROUNDWATER SAMPLING AND ANALYSIS
 PROJECT No. 40915034

SEMI-ANNUAL AND ANNUAL ROUTINE PARAMETERS STATISTICAL ANALYSIS SHEET

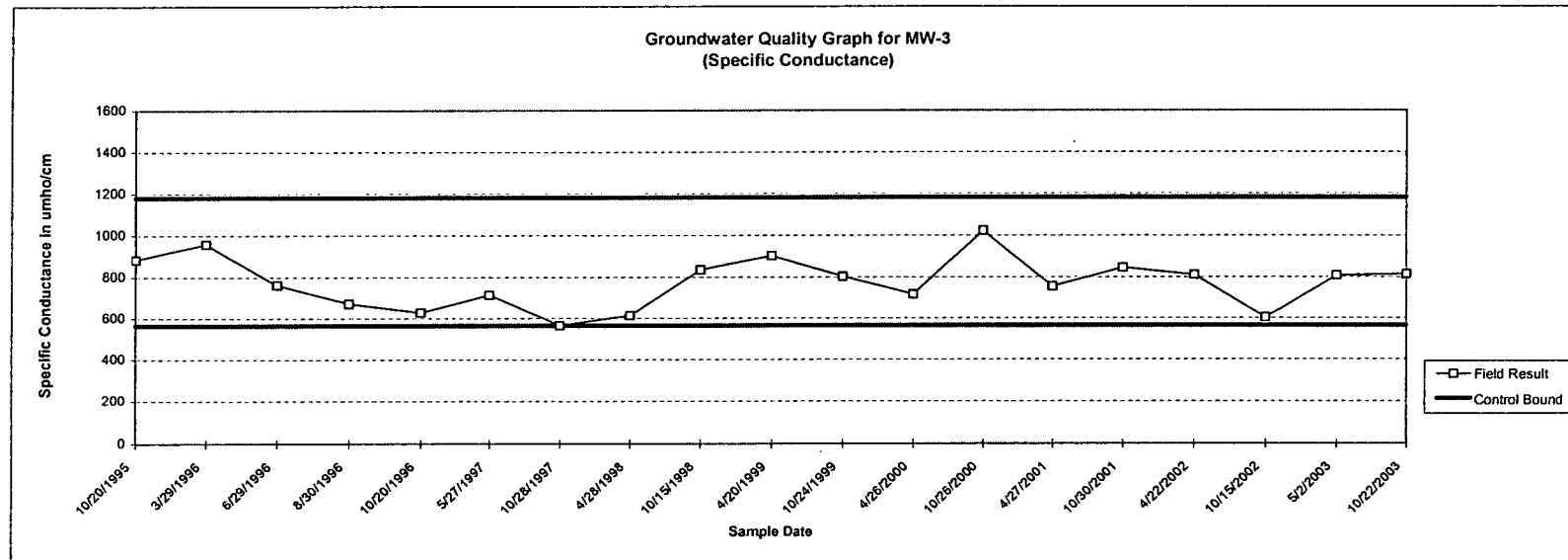


NOTE:

- 1) Results from Monitoring Well MW-5 were used to compute control limits - considered an up-gradient well.

ANALYSIS SHEET MW-3
MONONA COUNTY LANDFILL
GROUNDWATER SAMPLING AND ANALYSIS
PROJECT No. 40915034

SEMI-ANNUAL AND ANNUAL ROUTINE PARAMETERS STATISTICAL ANALYSIS SHEET



NOTE:

- 1) Results from Monitoring Well MW-5 were used to compute control limits - considered an up-gradient well.

ANALYSIS SHEET MW-2

**MONONA COUNTY LANDFILL
GROUNDWATER SAMPLING AND ANALYSIS
PROJECT No. 40915034**

SEMI-ANNUAL AND ANNUAL ROUTINE PARAMETERS STATISTICAL ANALYSIS SHEETSAMPLE LOCATION NO. **MW-2 (Down-gradient)**ANALYSIS PERFORMED BY: **TEST AMERICA INC.**SAMPLED BY: **TERRACON**

PARAMETER	Statistical Considerations				SAMPLE DATE												
	Upper Control Limit via MW-5	Lower Control Limit via MW-5	MW-2 Standard Deviation	MW-2 Mean	10/20/1995	3/29/1996	6/29/1996	8/30/1996	10/20/1996	5/27/1997	10/28/1997	4/28/1998	10/15/1998	4/20/1999	10/24/1999	4/26/2000	10/27/2000
Laboratory Parameters																	
Chloride (mg/l)	18.1	2.05	22.9	36.2	54.0	2.5	2.5	2.5	62	62	51	47	60	76	54	46.4	38
Chemical Oxygen Demand (mg/l)	14.4	0.00	12.23	8.83	9.3	7.5	20	10	7.6	2.5	7.6	2.5	2.5	2.5	5.7	7.1	2.5
Iron, dissolved (mg/l)	0.05	0.05	0.28	0.16	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.72	0.96	0.05
Nitrogen, Ammonia (mg/l)	0.30	0.00	0.05	0.11	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.31	0.1	0.1	0.1	0.1
Phenols, total (mg/l)	0.01	0.01	0.00	0.01	-	-	-	-	0.01	-	0.01	0.01	-	0.01	-	0.01	-
Total Organic Halogens (mg/l)	0.005	0.005	0.03	0.03	-	-	-	-	0.089	-	0.029	0.03	-	0.036	-	0.023	-
Field Parameters																	
pH (SU)	8.21	5.50	0.37	6.79	6.9	7.9	7.20	7.1	6.8	6.2	6.7	6.8	6.2	6.6	6.6	7.1	6.8
Specific Conductance (umho/cm)	1179	564	384	1255	883	957	760	670	1147	1204	1030	1173	1625	2100	1434	735	1922

NOTE:

- 1) Results shown in bold represent one-half of the laboratory detection limit (MDL) [for parameters reported below the MDL].
- 2) One-half of the MDL was used for parameters reported at concentrations below their respective MDL to compute their respective control limits (mean +/- two times the standard deviation for the chemicals observed at MW-5).
- 3) One-half of the MDL was graphed for parameters reported at concentrations below their respective MDL.
- 4) A lower control limit of zero (0) was used for those parameters in which a negative lower control limit was calculated.
- 5) Results from Monitoring Well MW-5 were used to compute control limits - considered up-gradient well

ANALYSIS SHEET MW-2

**MONONA COUNTY LANDFILL
GROUNDWATER SAMPLING AND ANALYSIS
PROJECT No. 40915034**

SEMI-ANNUAL AND ANNUAL ROUTINE PARAMETERS STATISTICAL ANALYSIS SHEET

SAMPLE LOCATION NO. MW-2 (Down-gradient)

ANALYSIS PERFORMED BY: TEST AMERICA INC.

SAMPLED BY: TERRACON

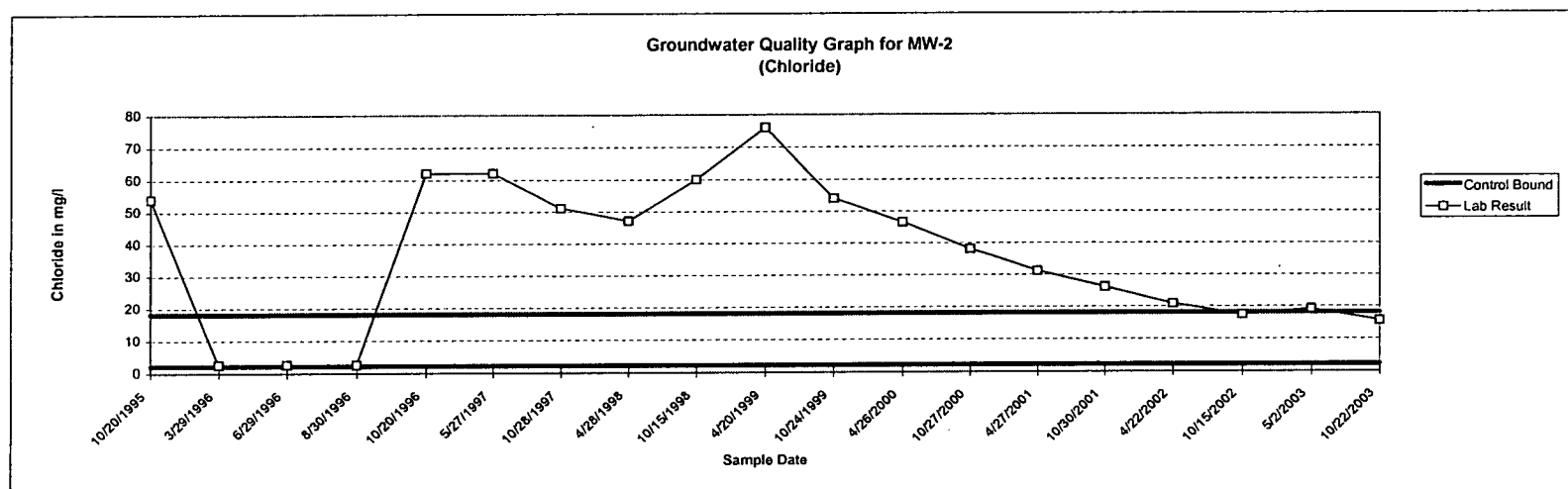
PARAMETER	Statistical Considerations				SAMPLE DATE					
	Upper Control Limit via MW-5	Lower Control Limit via MW-5	MW-2 Standard Deviation	MW-2 Mean	4/27/2001	10/30/2001	4/22/2002	10/15/2002	5/2/2003	10/22/2003
Laboratory Parameters										
Chloride (mg/l)	18.1	2.05	22.9	36.2	31.1	26.1	20.8	17.4	19.1	15.5
Chemical Oxygen Demand (mg/l)	14.4	0.00	12.23	8.83	2.5	2.5	2.5	10	56	7.0
Iron, dissolved (mg/l)	0.05	0.05	0.28	0.16	0.05	0.05	0.05	0.65	0.05	0.05
Nitrogen, Ammonia (mg/l)	0.30	0.00	0.05	0.11	0.1	0.1	0.1	0.1	0.1	0.1
Phenols, total (mg/l)	0.01	0.01	0.00	0.01	0.01	-	0.01	-	0.01	-
Total Organic Halogens (mg/l)	0.005	0.005	0.03	0.03	0.016	-	0.017	-	0.005	-
Field Parameters										
pH (SU)	8.21	5.50	0.37	6.79	6.7	6.7	6.9	6.6	6.5	6.7
Specific Conductance (umho/cm)	1179	564	384	1255	1300	1418	1468	1112	1431	1478

NOTE:

- Results shown in bold represent one-half of the laboratory detection limit (MDL) [for parameters reported below the MDL].
- One-half of the MDL was used for parameters reported at concentrations below their respective MDL to compute their respective control limits (mean +/- two times the standard deviation for the chemicals observed at MW-5).
- One-half of the MDL was graphed for parameters reported at concentrations below their respective MDL.
- A lower control limit of zero (0) was used for those parameters in which a negative lower control limit was calculated.
- Results from Monitoring Well MW-5 were used to compute control limits - considered up-gradient well

ANALYSIS SHEET MW-2
MONONA COUNTY LANDFILL
GROUNDWATER SAMPLING AND ANALYSIS
PROJECT No. 40915034

SEMI-ANNUAL AND ANNUAL ROUTINE PARAMETERS STATISTICAL ANALYSIS SHEET

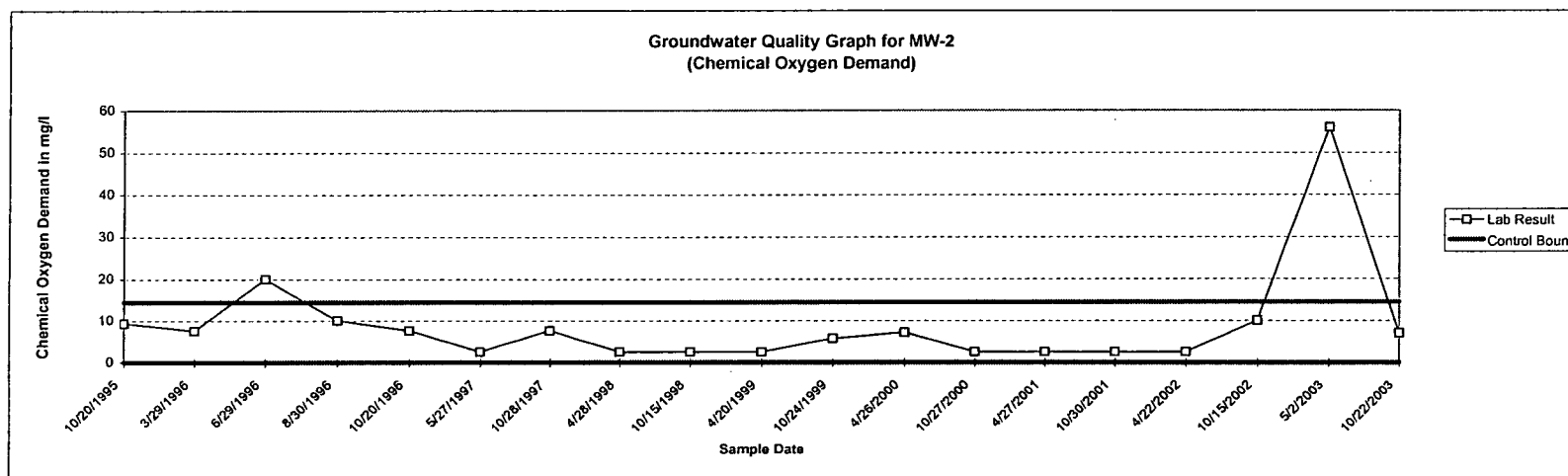


NOTE:

- 1) Results from Monitoring Well MW-5 were used to compute control limits - considered an up-gradient well.
- 2) One-half of the MDL was graphed for parameters reported at concentrations below their respective MDL.

ANALYSIS SHEET MW-2
MONONA COUNTY LANDFILL
GROUNDWATER SAMPLING AND ANALYSIS
PROJECT No. 40915034

SEMI-ANNUAL AND ANNUAL ROUTINE PARAMETERS STATISTICAL ANALYSIS SHEET

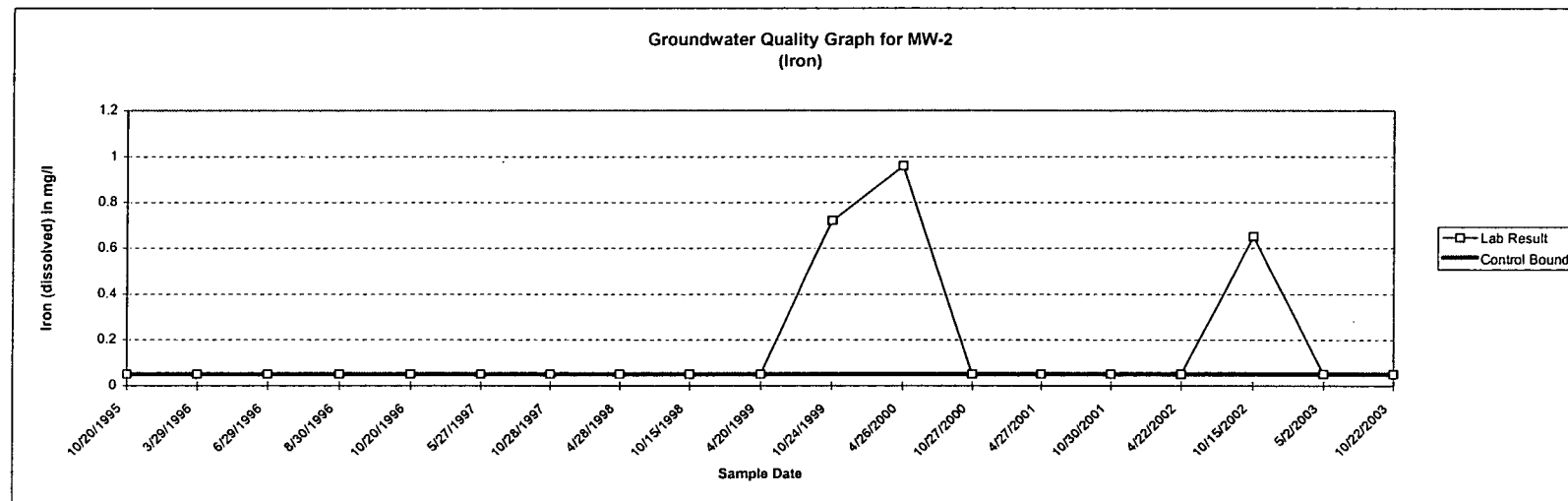


NOTE:

- 1) Results from Monitoring Well MW-5 were used to compute control limits - considered an up-gradient well.
- 2) A lower control limit of zero (0) was used for those parameters in which a negative lower control limit was calculated.
- 3) One-half of the MDL was graphed for parameters reported at concentrations below their respective MDL.

ANALYSIS SHEET MW-2
MONONA COUNTY LANDFILL
GROUNDWATER SAMPLING AND ANALYSIS
PROJECT No. 40915034

SEMI-ANNUAL AND ANNUAL ROUTINE PARAMETERS STATISTICAL ANALYSIS SHEET



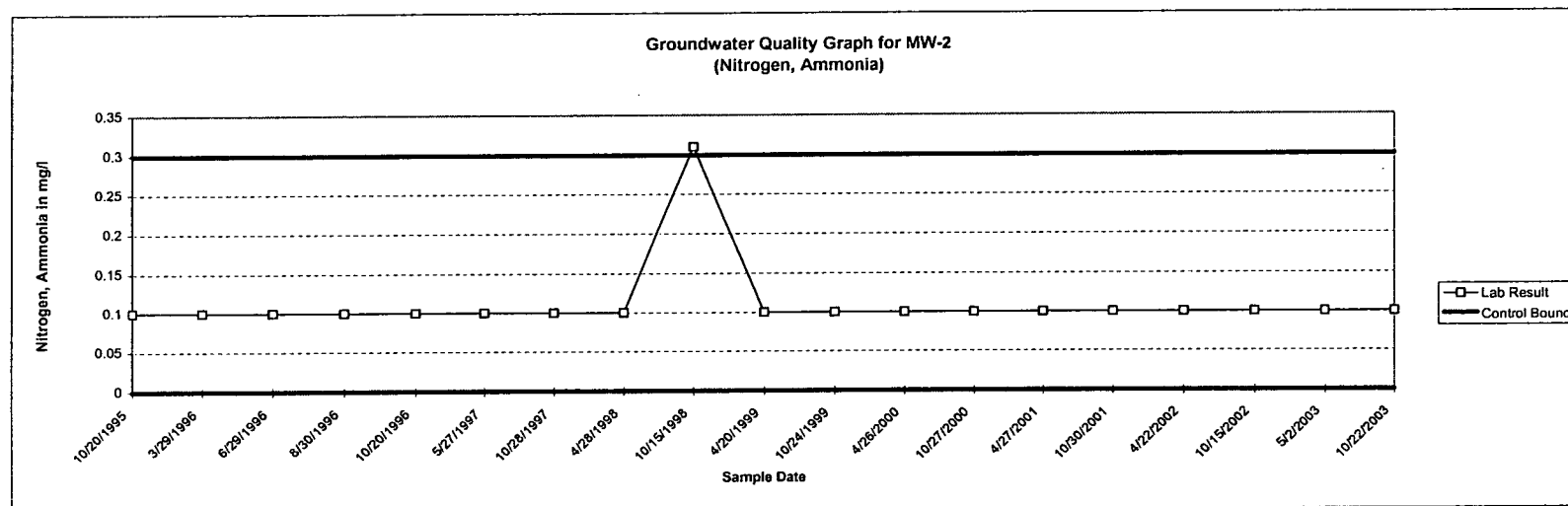
NOTE:

- 1) Results from Monitoring Well MW-5 were used to compute control limits - considered an up-gradient well.
- 2) The same non-detectable concentration results for MW-5 resulted in a single control bound (i.e. there was no deviation from the mean of the data).
- 3) One-half of the MDL was graphed for parameters reported at concentrations below their respective MDL.

ANALYSIS SHEET MW-2

MONONA COUNTY LANDFILL GROUNDWATER SAMPLING AND ANALYSIS PROJECT No. 40915034

SEMI-ANNUAL AND ANNUAL ROUTINE PARAMETERS STATISTICAL ANALYSIS SHEET

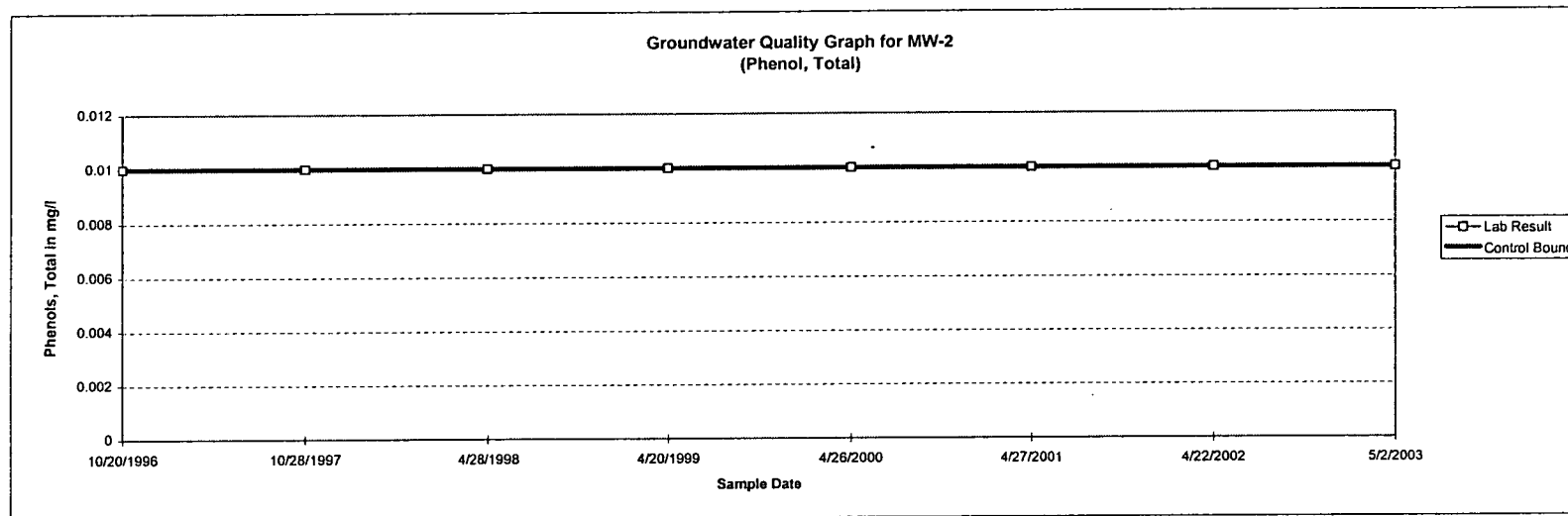


NOTE:

- 1) Results from Monitoring Well MW-5 were used to compute control limits - considered an up-gradient well.
- 2) A lower control limit of zero (0) was used for those parameters in which a negative lower control limit was calculated.
- 3) One-half of the MDL was graphed for parameters reported at concentrations below their respective MDL.

ANALYSIS SHEET MW-2
MONONA COUNTY LANDFILL
GROUNDWATER SAMPLING AND ANALYSIS
PROJECT No. 40915034

SEMI-ANNUAL AND ANNUAL ROUTINE PARAMETERS STATISTICAL ANALYSIS SHEET



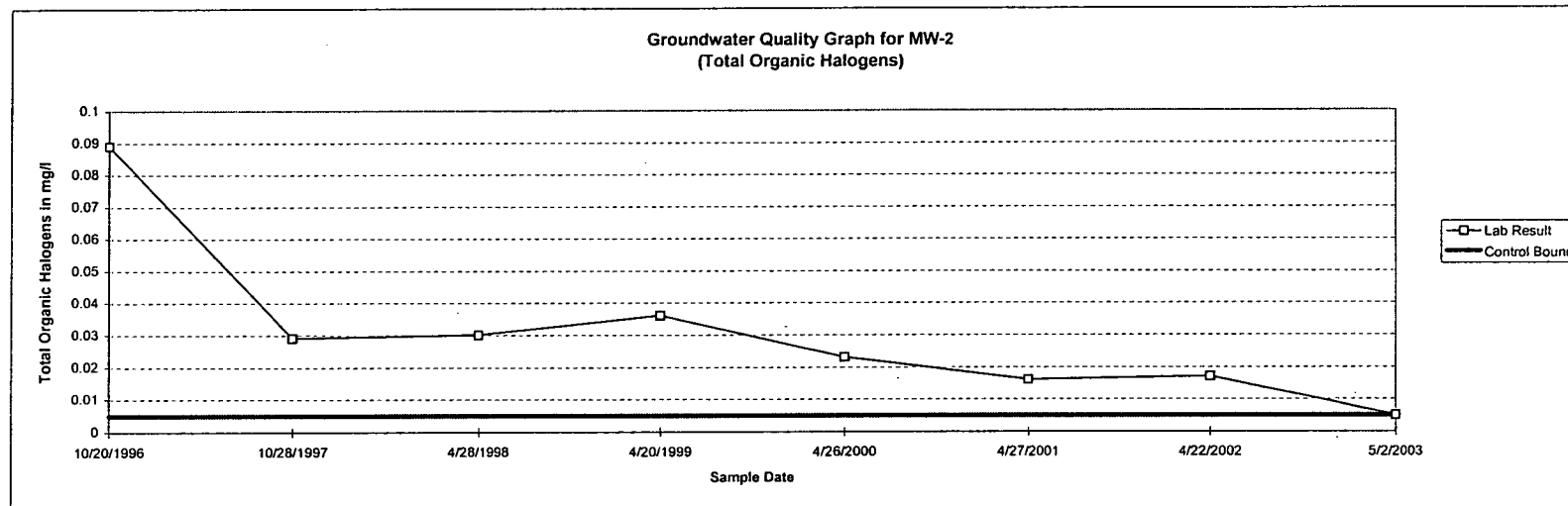
NOTE:

- 1) Results from Monitoring Well MW-5 were used to compute control limits - considered an up-gradient well.
- 2) The same non-detectable concentration results for MW-5 resulted in a single control bound (i.e. there was no deviation from the mean of the data).
- 3) One-half of the MDL was graphed for parameters reported at concentrations below their respective MDL.

ANALYSIS SHEET MW-2

MONONA COUNTY LANDFILL
GROUNDWATER SAMPLING AND ANALYSIS
PROJECT No. 40915034

SEMI-ANNUAL AND ANNUAL ROUTINE PARAMETERS STATISTICAL ANALYSIS SHEET



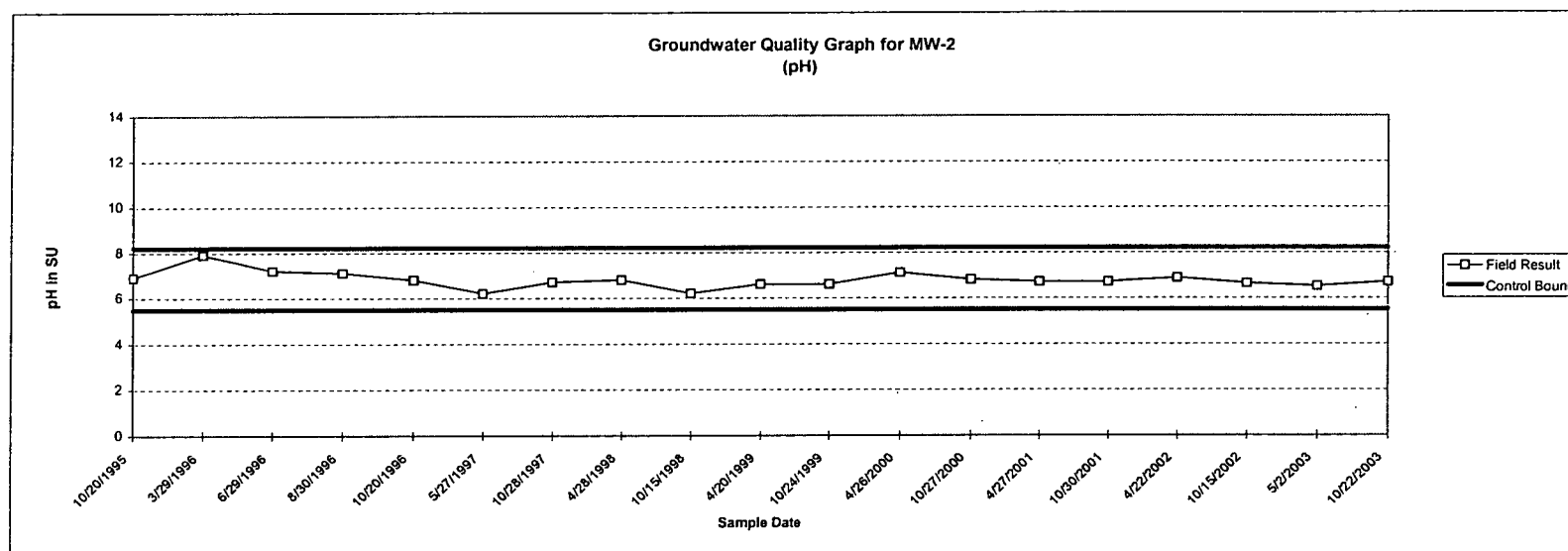
NOTE:

- 1) Results from Monitoring Well MW-5 were used to compute control limits - considered an up-gradient well.
- 2) The same non-detectable concentration results for MW-5 resulted in a single control bound (i.e. there was no deviation from the mean of the data).
- 3) One-half of the MDL was graphed for parameters reported at concentrations below their respective MDL.

ANALYSIS SHEET MW-2

MONONA COUNTY LANDFILL GROUNDWATER SAMPLING AND ANALYSIS PROJECT No. 40915034

SEMI-ANNUAL AND ANNUAL ROUTINE PARAMETERS STATISTICAL ANALYSIS SHEET



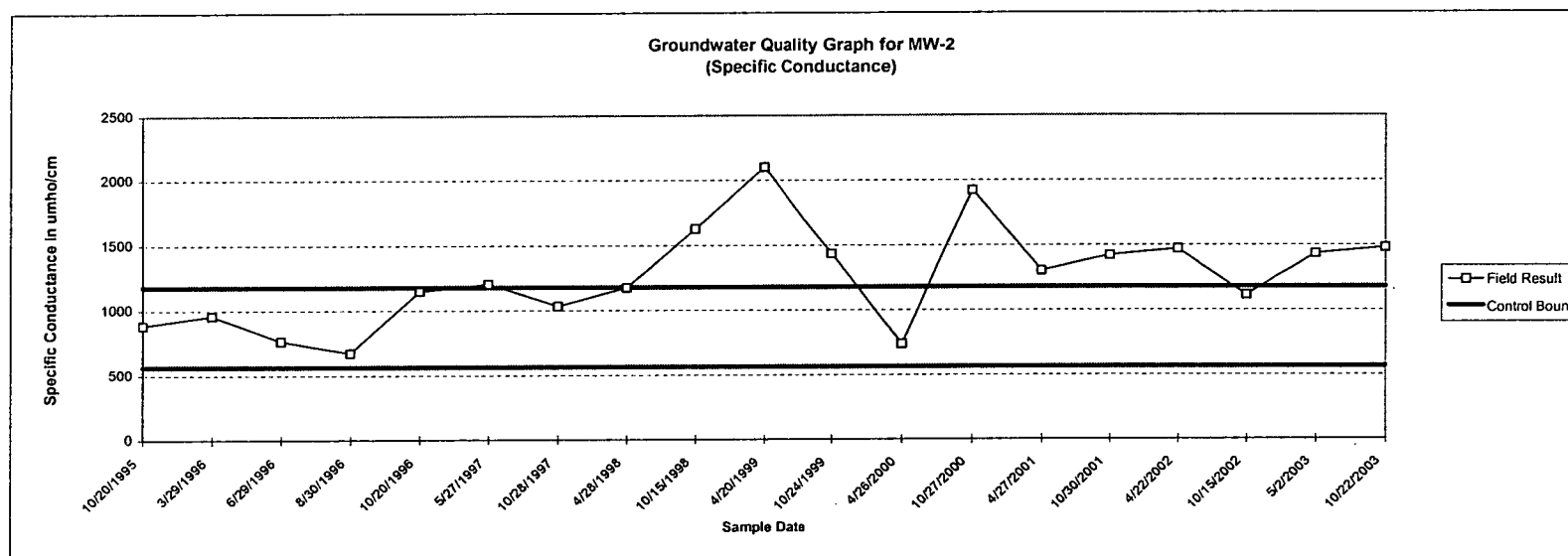
NOTE:

- 1) Results from Monitoring Well MW-5 were used to compute control limits - considered an up-gradient well.

ANALYSIS SHEET MW-2

MONONA COUNTY LANDFILL GROUNDWATER SAMPLING AND ANALYSIS PROJECT No. 40915034

SEMI-ANNUAL AND ANNUAL ROUTINE PARAMETERS STATISTICAL ANALYSIS SHEET



NOTE:

- 1) Results from Monitoring Well MW-5 were used to compute control limits - considered an up-gradient well.

ANALYSIS SHEET MW-1

**MONONA COUNTY LANDFILL
GROUNDWATER SAMPLING AND ANALYSIS
PROJECT No. 40915034**

SEMI-ANNUAL AND ANNUAL ROUTINE PARAMETERS STATISTICAL ANALYSIS SHEET

SAMPLE LOCATION NO. **MW-1 (Down-gradient)**ANALYSIS PERFORMED BY: **TEST AMERICA INC.**SAMPLED BY: **TERRACON**

PARAMETER	Statistical Considerations				SAMPLE DATE												
	Upper	Lower	MW-1 Standard Deviation	MW-1 Mean	10/20/1995	3/29/1996	6/29/1996	8/30/1996	10/20/1996	5/27/1997	10/28/1997	4/28/1998	10/15/1998	4/20/1999	10/24/1999	4/26/2000	10/27/2000
	Control Limit via MW-5	Control Limit via MW-5															
Laboratory Parameters																	
Chloride (mg/l)	18.1	2.05	2.54	10.5	5.9	7.5	8.7	8.2	6.8	8.4	7.9	13	12	11	11	14.6	12
Chemical Oxygen Demand (mg/l)	14.4	0.00	4.28	4.21	2.5	2.5	18	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5
Iron, dissolved (mg/l)	0.05	0.05	0.13	0.11	0.33	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.20	0.05	0.05
Nitrogen, Ammonia (mg/l)	0.30	0.00	0.05	0.11	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.3	0.1	0.1	0.1	0.1
Phenols, total (mg/l)	0.01	0.01	0.00	0.01	-	-	-	-	0.01	-	0.01	0.01	-	0.01	-	0.01	-
Total Organic Halogens (mg/l)	0.005	0.005	0.06	0.04	-	-	-	-	0.19	-	0.005	0.005	-	0.018	-	0.017	-
Field Parameters																	
pH (SU)	8.21	5.50	0.27	6.89	7.3	7.7	7.10	6.9	7.0	6.7	7.0	7.0	6.6	6.7	6.7	6.8	6.9
Specific Conductance (umho/cm)	1179	564	212	931	869	993	790	660	679	717	579	702	953	1000	868	870	1087

NOTE:

- 1) Results shown in bold represent one-half of the laboratory detection limit (MDL) [for parameters reported below the MDL].
- 2) One-half of the MDL was used for parameters reported at concentrations below their respective MDL to compute their respective control limits (mean +/- two times the standard deviation for the chemicals observed at MW-5).
- 3) One-half of the MDL was graphed for parameters reported at concentrations below their respective MDL.
- 4) A lower control limit of zero (0) was used for those parameters in which a negative lower control limit was calculated.
- 5) Results from Monitoring Well MW-5 were used to compute control limits - considered up-gradient well

ANALYSIS SHEET MW-1

**MONONA COUNTY LANDFILL
GROUNDWATER SAMPLING AND ANALYSIS
PROJECT No. 40915034**

SEMI-ANNUAL AND ANNUAL ROUTINE PARAMETERS STATISTICAL ANALYSIS SHEET

SAMPLE LOCATION NO. MW-1 (Down-gradient)

ANALYSIS PERFORMED BY: TEST AMERICA INC.

SAMPLED BY: TERRACON

PARAMETER	Statistical Considerations				SAMPLE DATE					
	Upper Control Limit via MW-5	Lower Control Limit via MW-5	MW-1 Standard Deviation	MW-1 Mean	4/27/2001	10/30/2001	4/22/2002	10/15/2002	5/2/2003	10/22/2003
Laboratory Parameters										
Chloride (mg/l)	18.1	2.05	2.54	10.5	14.2	12.2	13	10.2	11.7	10.8
Chemical Oxygen Demand (mg/l)	14.4	0.00	4.28	4.21	11	2.5	2.5	11	2.5	2.5
Iron, dissolved (mg/l)	0.05	0.05	0.127	0.111	0.05	0.41	0.05	0.41	0.05	0.05
Nitrogen, Ammonia (mg/l)	0.30	0.00	0.046	0.111	0.1	0.1	0.1	0.1	0.1	0.1
Phenols, total (mg/l)	0.01	0.01	0.000	0.010	0.01	-	0.01	-	0.01	-
Total Organic Halogens (mg/l)	0.005	0.005	0.063	0.036	0.017	-	0.021	-	0.011	-
Field Parameters										
pH (SU)	8.21	5.50	0.27	6.89	6.8	6.8	6.9	6.9	6.5	6.6
Specific Conductance (umho/cm)	1179	564	212	931	1085	1101	1218	959	1259	1305

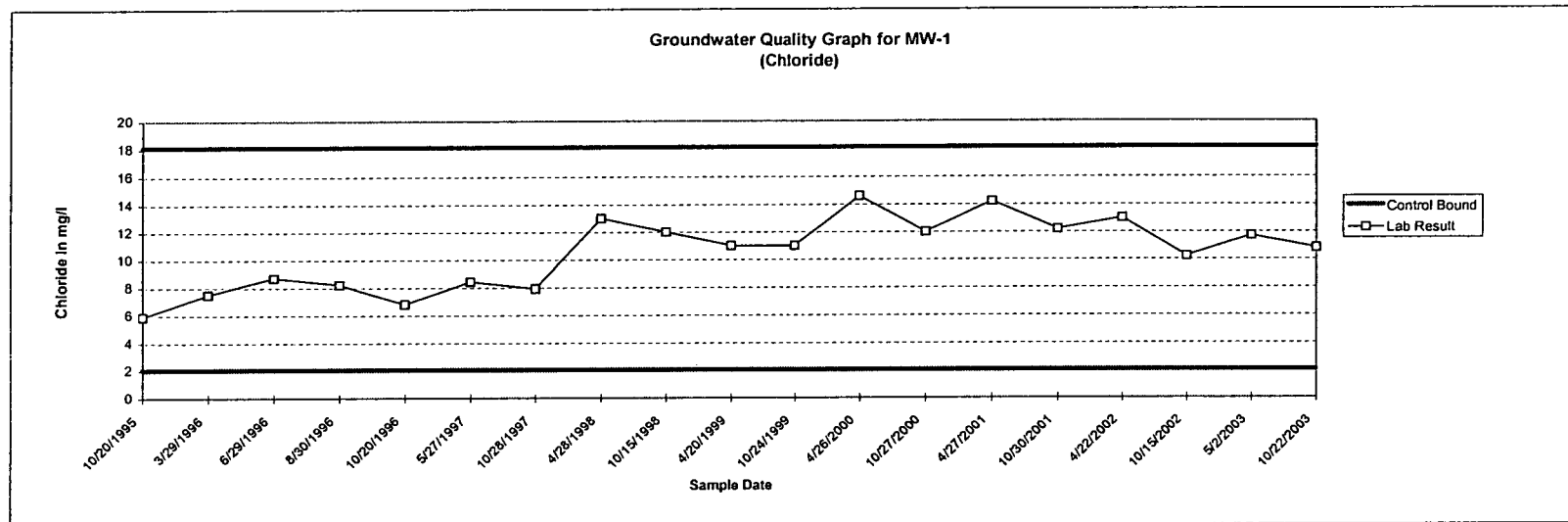
NOTE:

- 1) Results shown in bold represent one-half of the laboratory detection limit (MDL) [for parameters reported below the MDL].
- 2) One-half of the MDL was used for parameters reported at concentrations below their respective MDL to compute their respective control limits (mean +/- two times the standard deviation for the chemicals observed at MW-5).
- 3) One-half of the MDL was graphed for parameters reported at concentrations below their respective MDL.
- 4) A lower control limit of zero (0) was used for those parameters in which a negative lower control limit was calculated.
- 5) Results from Monitoring Well MW-5 were used to compute control limits - considered up-gradient well

ANALYSIS SHEET MW-1

MONONA COUNTY LANDFILL
GROUNDWATER SAMPLING AND ANALYSIS
PROJECT No. 40915034

SEMI-ANNUAL AND ANNUAL ROUTINE PARAMETERS STATISTICAL ANALYSIS SHEET



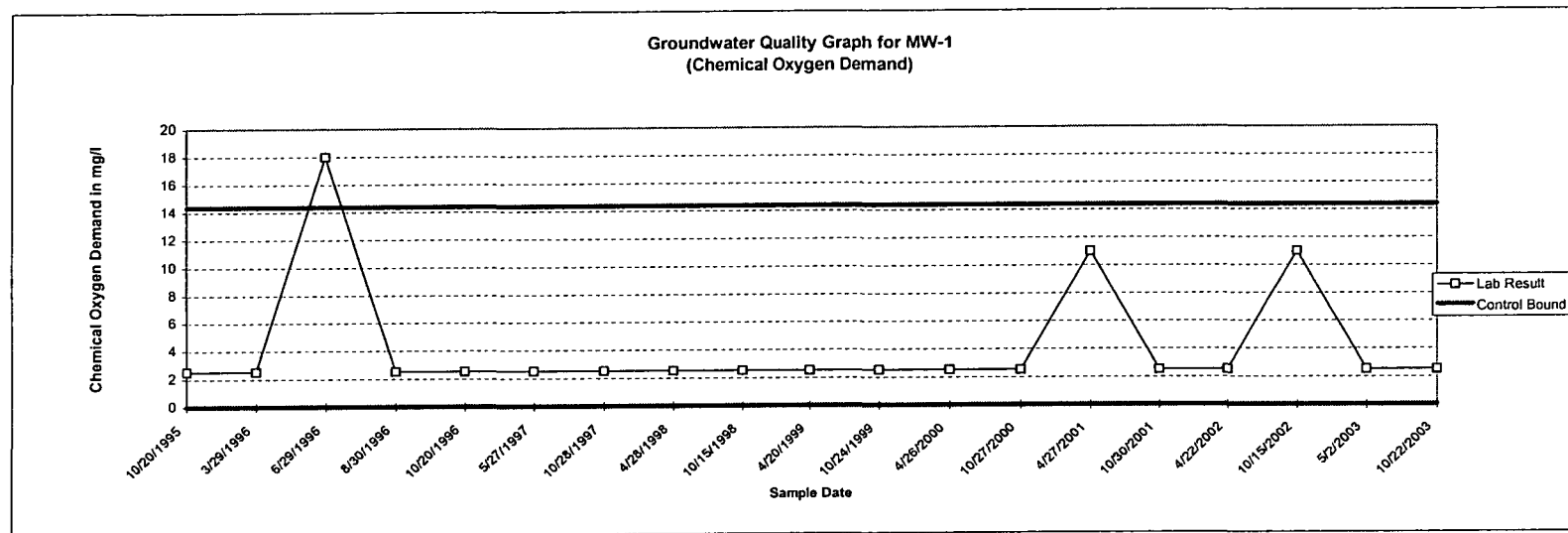
NOTE:

- 1) Results from Monitoring Well MW-5 were used to compute control limits - considered an up-gradient well.

ANALYSIS SHEET MW-1

MONONA COUNTY LANDFILL
GROUNDWATER SAMPLING AND ANALYSIS
PROJECT No. 40915034

SEMI-ANNUAL AND ANNUAL ROUTINE PARAMETERS STATISTICAL ANALYSIS SHEET

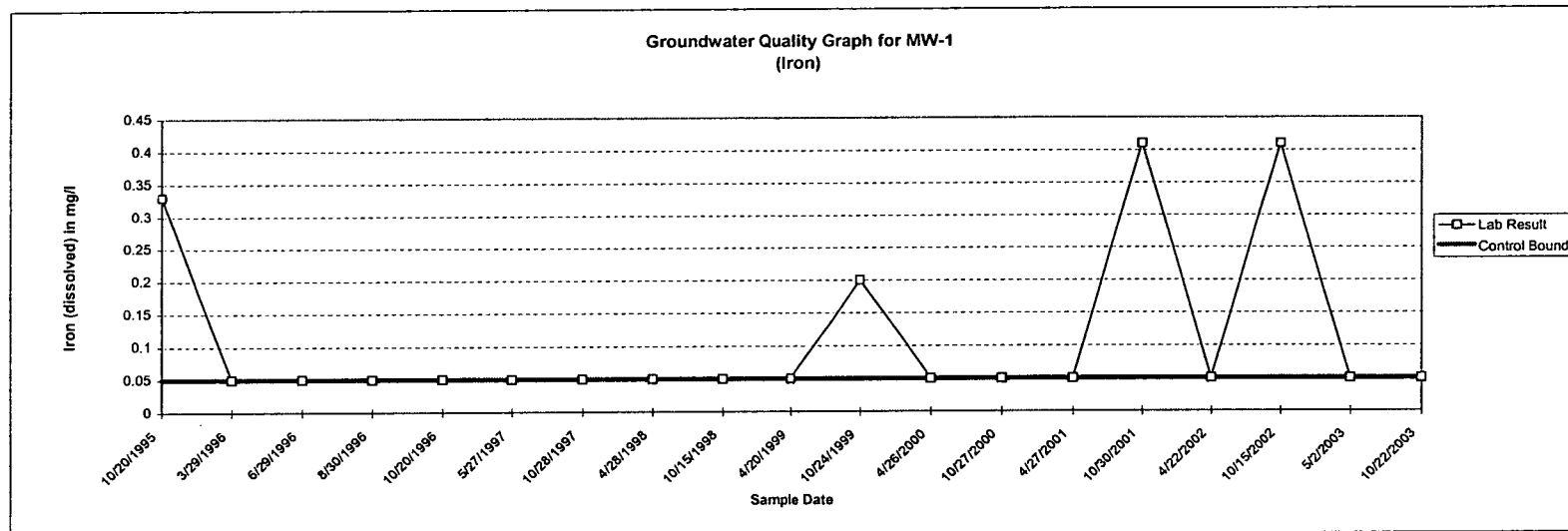


NOTE:

- 1) Results from Monitoring Well MW-5 were used to compute control limits - considered an up-gradient well.
- 2) A lower control limit of zero (0) was used for those parameters in which a negative lower control limit was calculated.
- 3) One-half of the MDL was graphed for parameters reported at concentrations below their respective MDL.

ANALYSIS SHEET MW-1
MONONA COUNTY LANDFILL
GROUNDWATER SAMPLING AND ANALYSIS
PROJECT No. 40915034

SEMI-ANNUAL AND ANNUAL ROUTINE PARAMETERS STATISTICAL ANALYSIS SHEET

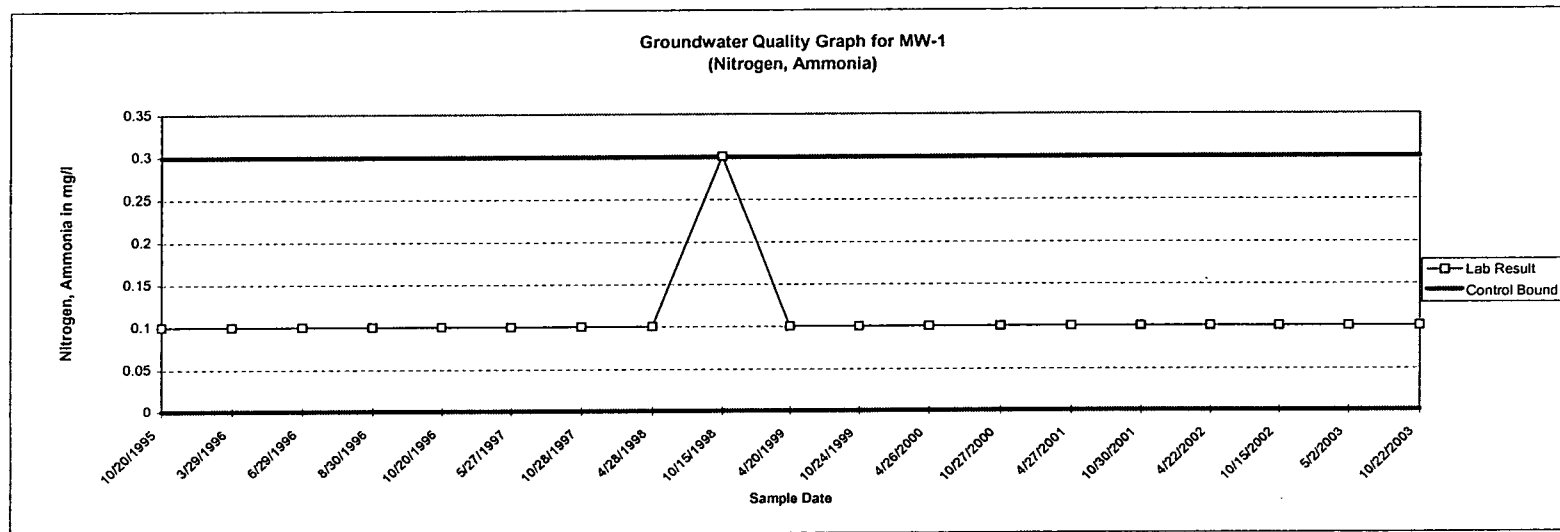


NOTE:

- 1) Results from Monitoring Well MW-5 were used to compute control limits - considered an up-gradient well.
- 2) The same non-detectable concentration results for MW-5 resulted in a single control bound (i.e. there was no deviation from the mean of the data).
- 3) One-half of the MDL was graphed for parameters reported at concentrations below their respective MDL.

ANALYSIS SHEET MW-1
MONONA COUNTY LANDFILL
GROUNDWATER SAMPLING AND ANALYSIS
PROJECT No. 40915034

SEMI-ANNUAL AND ANNUAL ROUTINE PARAMETERS STATISTICAL ANALYSIS SHEET

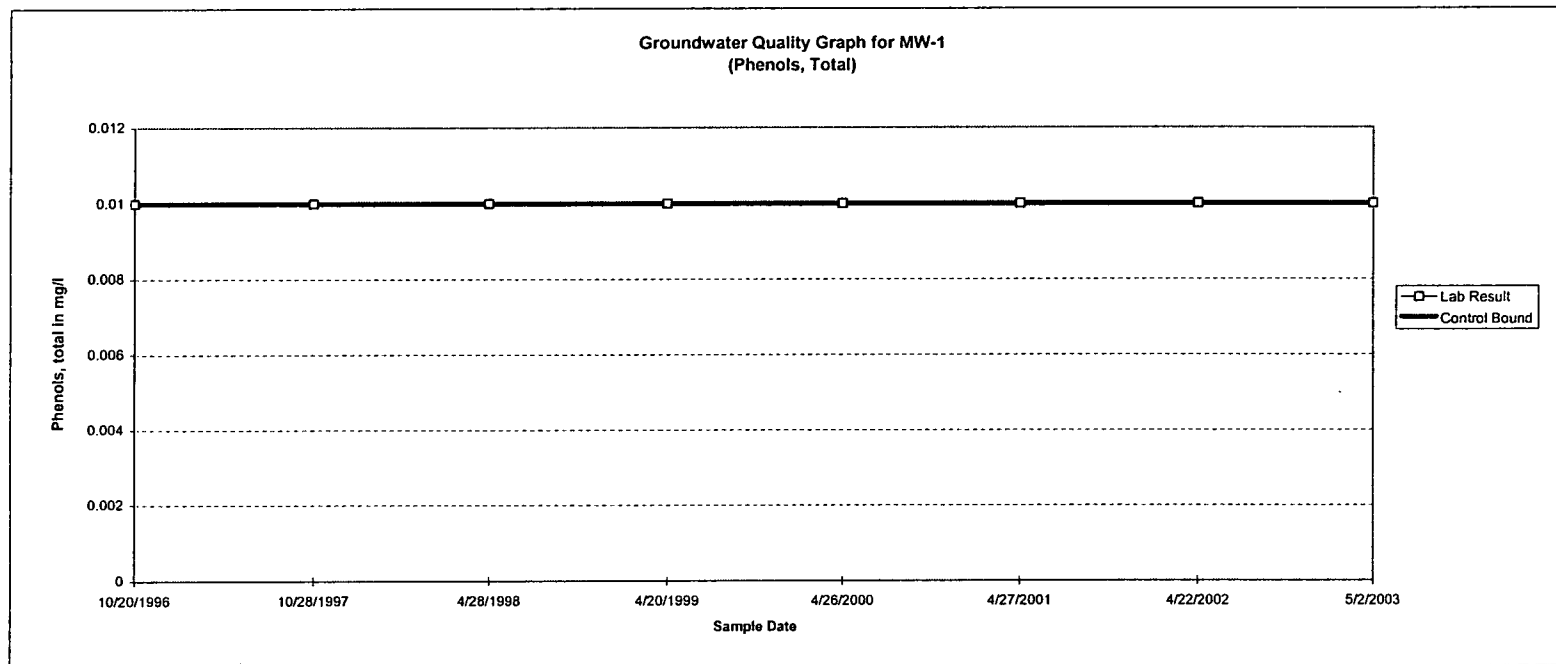


NOTE:

- 1) Results from Monitoring Well MW-5 were used to compute control limits - considered an up-gradient well.
- 2) A lower control limit of zero (0) was used for those parameters in which a negative lower control limit was calculated.
- 3) One-half of the MDL was graphed for parameters reported at concentrations below their respective MDL.

ANALYSIS SHEET MW-1
MONONA COUNTY LANDFILL
GROUNDWATER SAMPLING AND ANALYSIS
PROJECT No. 40915034

SEMI-ANNUAL AND ANNUAL ROUTINE PARAMETERS STATISTICAL ANALYSIS SHEET

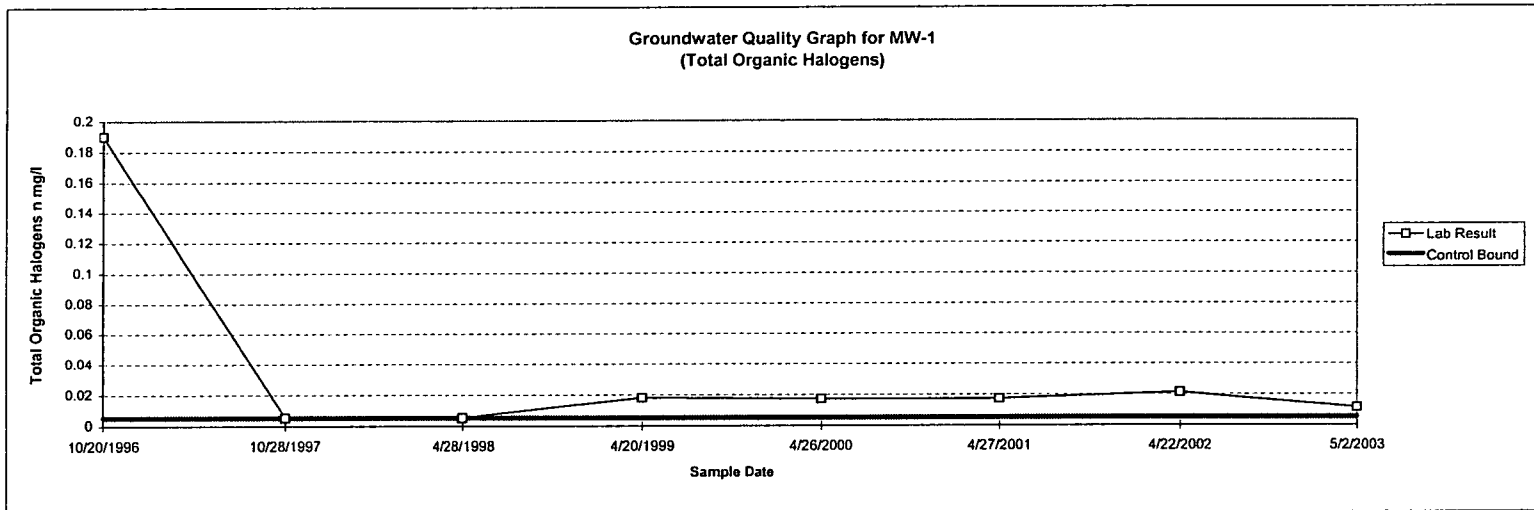


NOTE:

- 1) Results from Monitoring Well MW-5 were used to compute control limits - considered an up-gradient well.
- 2) The same non-detectable concentration results for MW-5 resulted in a single control bound (i.e. there was no deviation from the mean of the data).
- 3) One-half of the MDL was graphed for parameters reported at concentrations below their respective MDL.

ANALYSIS SHEET MW-1
MONONA COUNTY LANDFILL
GROUNDWATER SAMPLING AND ANALYSIS
PROJECT No. 40915034

SEMI-ANNUAL AND ANNUAL ROUTINE PARAMETERS STATISTICAL ANALYSIS SHEET



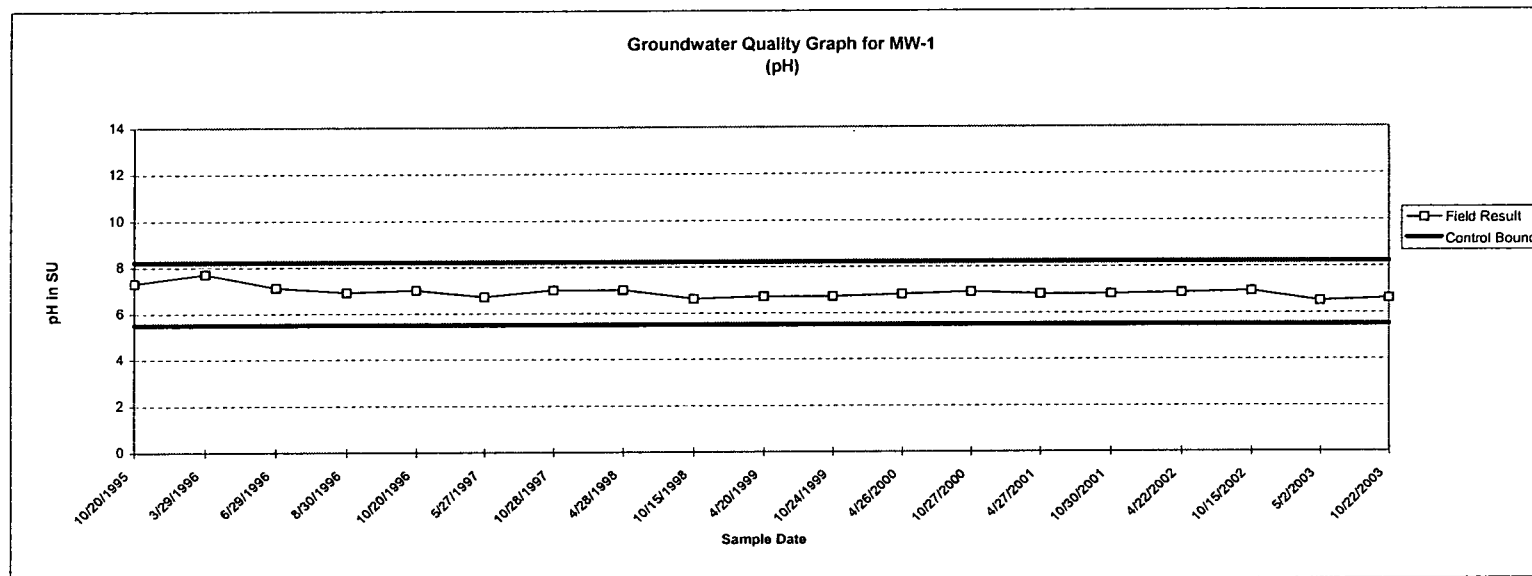
NOTE:

- 1) Results from Monitoring Well MW-5 were used to compute control limits - considered an up-gradient well.
- 2) The same non-detectable concentration results for MW-5 resulted in a single control bound (i.e. there was no deviation from the mean of the data).
- 3) One-half of the MDL was graphed for parameters reported at concentrations below their respective MDL.

ANALYSIS SHEET MW-1

MONONA COUNTY LANDFILL
GROUNDWATER SAMPLING AND ANALYSIS
PROJECT No. 40915034

SEMI-ANNUAL AND ANNUAL ROUTINE PARAMETERS STATISTICAL ANALYSIS SHEET



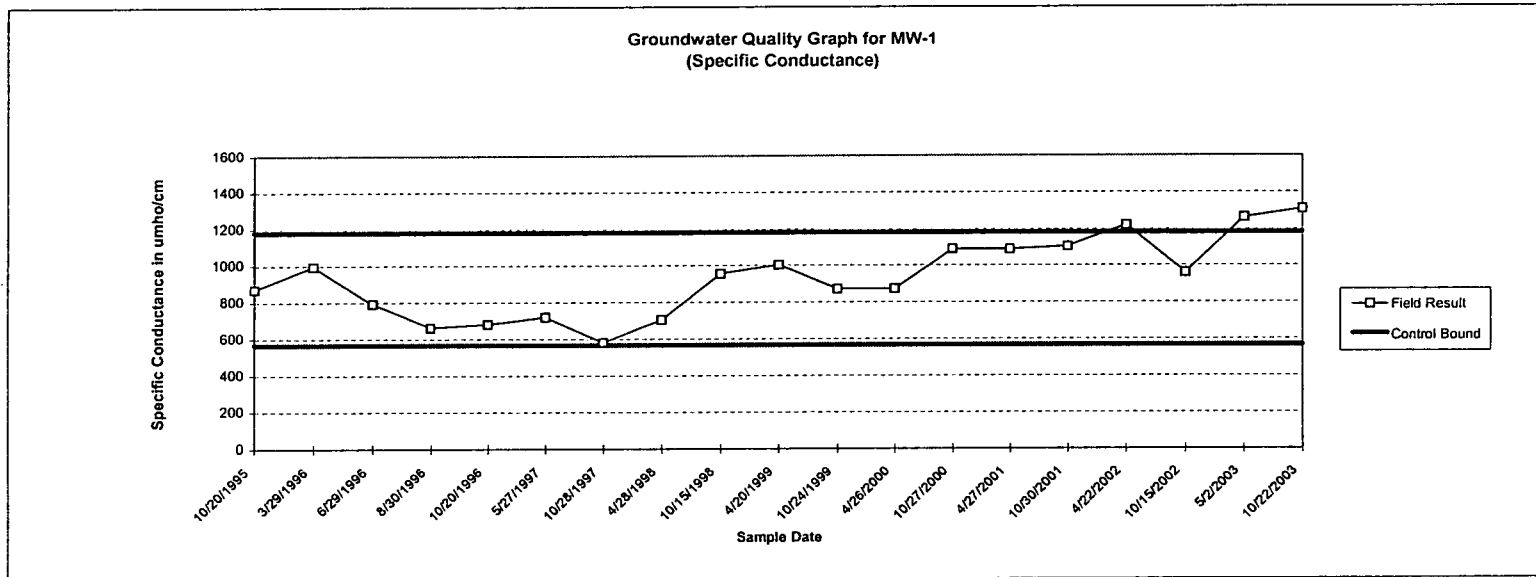
NOTE:

- 1) Results from Monitoring Well MW-5 were used to compute control limits - considered an up-gradient well.

ANALYSIS SHEET MW-1

MONONA COUNTY LANDFILL GROUNDWATER SAMPLING AND ANALYSIS PROJECT No. 40915034

SEMI-ANNUAL AND ANNUAL ROUTINE PARAMETERS STATISTICAL ANALYSIS SHEET



NOTE:

- 1) Results from Monitoring Well MW-5 were used to compute control limits - considered an up-gradient well.

TABLE 1
Monona County Lndfill
Terracon Project No. 40915034

Summary of Groundwater Elevation Measurements

Measurement Dates			December 2002		January 2003		February 2003		March 2003	
Location	TOC Elevation (feet)	Screened Interval Elevation (feet)	Depth to Water (feet)	Groundwater Elevation (feet)	Depth to Water (feet)	Groundwater Elevation (feet)	Depth to Water (feet)	Groundwater Elevation (feet)	Depth to Water (feet)	Groundwater Elevation (feet)
MW-1	1219.73	1192.3-1177.3	NM	NM	29.8	1189.93	29.8	1189.93	29.7	1190.03
MW-2	1222.38	1192.9-1177.9	NM	NM	35.3	1187.08	35.1	1187.28	35.0	1187.38
MW-3	1266.15	1215.2-1200.2	NM	NM	48.2	1217.95	48.3	1217.85	48.3	1217.85
MW-4	1261.62	1208.6-1193.6	NM	NM	52.6	1209.02	52.5	1209.12	52.3	1209.32
MW-5	1335.73	1229.0-1214.0	NM	NM	104.6	1231.13	104.7	1231.03	104.6	1231.13

NOTES:

TOC = top of casing elevation (feet)

Water level depths were measured and reported by the landfill operator with exception of levels for May and October 2003

Bold numbers represent water levels outside screened intervals

NM = Not Measured

1
2
3
4
5

TABLE 1
Monona County Lndfill
Terracon Project No. 40915034

Summary of Groundwater Elevation Measurements

Measurement Dates			April 2003		May 2003		June 2003		July 2003	
Location	TOC Elevation (feet)	Screened Interval Elevation (feet)	Depth to Water (feet)	Groundwater Elevation (feet)	Depth to Water (feet)	Groundwater Elevation (feet)	Depth to Water (feet)	Groundwater Elevation (feet)	Depth to Water (feet)	Groundwater Elevation (feet)
MW-1	1219.73	1192.3-1177.3	29.6	1190.13	30.05	1189.68	29.5	1190.23	29.6	1190.13
MW-2	1222.38	1192.9-1177.9	34.8	1187.58	35.51	1186.87	35.0	1187.38	35.0	1187.38
MW-3	1266.15	1215.2-1200.2	48.0	1218.15	50.02	1216.13	48.1	1218.05	48.0	1218.15
MW-4	1261.62	1208.6-1193.6	52.4	1209.22	53.15	1208.47	53.0	1208.62	52.4	1209.22
MW-5	1335.73	1229.0-1214.0	103.9	1231.83	104.79	1230.94	104.8	1230.93	103.9	1231.83

NOTES:

TOC = top of casing elevation (feet)

Water level depths were measured and reported by the landfill operator with exception of levels for May and October 2003

Bold numbers represent water levels outside screened intervals

TABLE 1
Monona County Lndfill
Terracon Project No. 40915034

Summary of Groundwater Elevation Measurements

Measurement Dates			August 2003		September 2003		October 2003		November 2003	
Location	TOC Elevation (feet)	Screened Interval Elevation (feet)	Depth to Water (feet)	Groundwater Elevation (feet)	Depth to Water (feet)	Groundwater Elevation (feet)	Depth to Water (feet)	Groundwater Elevation (feet)	Depth to Water (feet)	Groundwater Elevation (feet)
MW-1	1219.73	1192.3-1177.3	29.6	1190.13	29.9	1189.83	31.73	1188.00	29.6	1190.13
MW-2	1222.38	1192.9-1177.9	35.0	1187.38	35.1	1187.28	37.14	1185.24	35.2	1187.18
MW-3	1266.15	1215.2-1200.2	48.0	1218.15	48.3	1217.85	50.52	1215.63	48.0	1218.15
MW-4	1261.62	1208.6-1193.6	52.2	1209.42	52.2	1209.42	53.31	1208.31	52.5	1209.12
MW-5	1335.73	1229.0-1214.0	104.0	1231.73	104.4	1231.33	104.77	1230.96	104.5	1231.23

NOTES:

TOC = top of casing elevation (feet)

Water level depths were measured and reported by the landfill operator with exception of levels for May and October 2003

Bold numbers represent water levels outside screened intervals

TABLE 2
Monona County Landfill
Terracon Project No. 40915034

Summary of Leachate Measurements

Location	Measurement Dates											
	Dec 2002	Jan 2003	Feb 2003	Mar 2003	Apr 2003	May 2003	Jun 2003	Jul 2003	Aug 2003	Sep 2003	Oct 2003	Nov 2003
LW-1	NM	dry	dry	dry	dry	0.5 ft	dry	dry	dry	dry	1 ft	dry
LW-2	NM	1 ft	2 ft	6 ft	8 ft	9 ft	2.5 ft	2 ft	6 ft	1 ft	10 ft	1.5 ft
LW-3	NM	dry	dry	dry	dry	dry	dry	dry	dry	dry	dry	dry

NOTES:

Values presented above represent leachate thicknesses in feet.

Leachate levels measured by landfill operator, except for months of May and October when leachate levels were measured by Terracon.

NM indicates not measured.

Terracon

TABLE 3
Monona County Landfill
Terracon Project No. 40915034

Summary of Hydraulic Conductivity Measurements

DATE	MONITORING WELLS				
	MW-1	MW-2	MW-3	MW-4	MW-5
Nov - 1992	8.10E-05	4.00E-04	4.20E-05	3.00E-05	1.60E-05
Oct - 1998	2.03E-04	1.18E-03	5.53E-05	1.70E-05	2.10E-05
Oct - 2003	1.04E-04	7.27E-05	2.70E-05	2.72E-05	6.07E-05

Hydraulic conductivity values given in units of centimeters per second (cm/sec).

BOUWER AND RICE SLUG-OUT TEST ANALYSIS

MONITORING WELL MW-1

Monona County Landfill

Monona County, Iowa

Project No. 40915034

Well Geometry

Saturated Thickness (H), ft.	50	Radius of Well Casing (Rc), in	1
Screen Length, ft.	15	Radius of Boring (Rw), in	4
Depth to Water, ft.	31.73	Gravel Pack Porosity (n), %	20%
Well Depth, ft.	43.05	Time Delay Factor, min:	0.02

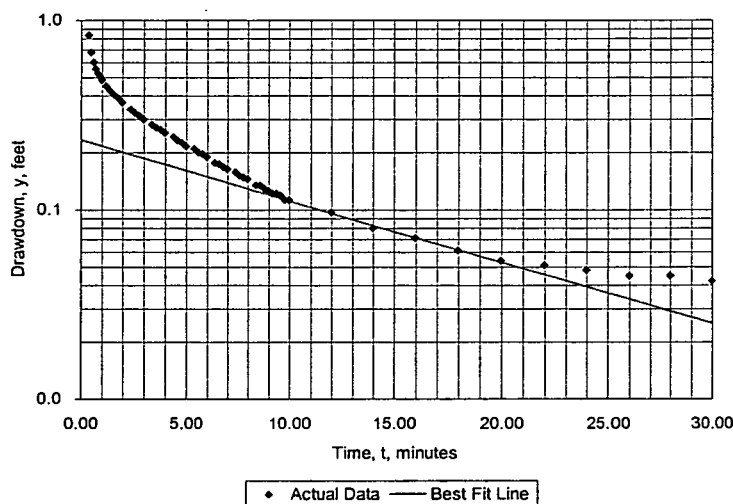
Computed Data

Effective Well Radius (Re), in.	2.0	Lw/Rw, ft/ft	33.96
Effective Screen Length (Le), ft.	11.32	Lw, ft	11.32
Full or Partial Penetration (F/P)	Partial	Le/Rw, ft/ft	33.96

Well Geometry Factors (See Attached Graph)

A	2.5688	Note: - Factors A and B are used for a partially penetrating well - Factor C is used for a fully penetrating well
B	0.41282	
C		

BOUWER AND RICE SLUG TEST ANALYSIS



Regression Analysis (Ln y vs. t)

Slope of Line, (1/minutes):	0.074326814
Yo, ft	0.233756723
Ln(Re/rw)	2.244812092
Regression Coefficient, R ² :	100%

Determination of Hydraulic Conductivity

Conductivity, ft/minute	2.05E-04
ft/day	2.95E-01
cm/sec	1.04E-04
m/day	8.99E-02

Note: The first 10 minutes of data points are thought to represent filter pack drainage and the last 5 data points indicative of inherent deviation from linear recovery. These points are, therefore, not included in the linear regression analysis.

References:

- 1) Bouwer, Herman. The Bouwer and Rice Slug Test - An Update. Groundwater. June 1989.
- 2) Bouwer, Herman and Rice, R.C. A Slug test for Determining Hydraulic Conductivity of Unconfined Aquifers with Completely or Partially Penetrating Wells. Water Resources Research. June 1976

BOUWER AND RICE SLUG-OUT TEST ANALYSIS
MONITORING WELL MW-1
Monona County Landfill
Monona County, Iowa
Project No. 40915034

Elapsed Time minutes	Corrected Time (t) minutes	Depth to Water feet	Drawdown feet	Predicted Drawdown feet
0.0600	0.0367	33.698	1.968	0.233119951
0.1200	0.0967	33.333	1.603	0.232082642
0.2400	0.2167	32.867	1.137	0.230021851
0.3666	0.3433	32.567	0.837	0.227867549
0.4833	0.4600	32.408	0.678	0.225899587
0.6000	0.5767	32.331	0.601	0.223948621
0.7000	0.6767	32.285	0.555	0.222290253
0.8000	0.7767	32.256	0.526	0.220644165
0.9000	0.8767	32.234	0.504	0.219010267
1.0000	0.9767	32.214	0.484	0.217388468
1.2000	1.1767	32.179	0.449	0.21418081
1.4000	1.3767	32.156	0.426	0.211020483
1.6000	1.5767	32.134	0.404	0.207906787
1.8000	1.7767	32.117	0.387	0.204839035
2.0000	1.9767	32.098	0.368	0.20181655
2.4000	2.3767	32.069	0.339	0.195904714
2.6000	2.5767	32.056	0.326	0.193014058
2.8000	2.7767	32.043	0.313	0.190166055
3.0000	2.9767	32.03	0.3	0.187360075
3.4000	3.3767	32.011	0.281	0.181871715
3.6000	3.5767	32.001	0.271	0.179188122
3.8000	3.7767	31.995	0.265	0.176544126
4.0000	3.9767	31.985	0.255	0.173939143
4.4000	4.3767	31.972	0.242	0.168843924
4.6000	4.5767	31.962	0.232	0.166352561
4.8000	4.7767	31.956	0.226	0.16389796
5.0000	4.9767	31.946	0.216	0.161479577
5.4000	5.3767	31.94	0.21	0.156749337
5.6000	5.5767	31.93	0.2	0.154436435
5.8000	5.7767	31.927	0.197	0.15215766
6.0000	5.9767	31.92	0.19	0.14991251
6.4000	6.3767	31.907	0.177	0.145521106
6.6000	6.5767	31.904	0.174	0.143373881
6.8000	6.7767	31.898	0.168	0.14125834
7.0000	6.9767	31.894	0.164	0.139174014
7.4000	7.3767	31.888	0.158	0.135097173
7.6000	7.5767	31.881	0.151	0.133103758
7.8000	7.7767	31.878	0.148	0.131139756
8.0000	7.9767	31.875	0.145	0.129204734
8.4000	8.3767	31.865	0.135	0.125419925
8.6000	8.5767	31.865	0.135	0.123569302
8.8000	8.7767	31.859	0.129	0.121745985
9.0000	8.9767	31.856	0.126	0.119949572
9.2000	9.1767	31.852	0.122	0.118179666
9.4000	9.3767	31.852	0.122	0.116435875
9.6000	9.5767	31.849	0.119	0.114717815
9.8000	9.7767	31.843	0.113	0.113025106
10.0000	9.9767	31.843	0.113	0.111357373
12.0000	11.9767	31.827	0.097	0.095975311
14.0000	13.9767	31.81	0.08	0.08271801
16.0000	15.9767	31.801	0.071	0.071291972
18.0000	17.9767	31.791	0.061	0.06144424
20.0000	19.9767	31.784	0.054	0.052956799
22.0000	21.9767	31.781	0.051	0.045641749
24.0000	23.9767	31.778	0.048	0.039337144
26.0000	25.9767	31.775	0.045	0.03390341
28.0000	27.9767	31.775	0.045	0.02922025
30.0000	29.9767	31.772	0.042	0.025183986

BOUWER AND RICE SLUG-OUT TEST ANALYSIS

MONITORING WELL MW-2

Monona County Landfill

Monona County, Iowa

Project No. 40915034

Well Geometry

Saturated Thickness (H), ft.	50	Radius of Well Casing (Rc), in	1
Screen Length, ft.	15	Radius of Boring (Rw), in	4
Depth to Water, ft.	37.14	Gravel Pack Porosity (n), %	20%
Well Depth, ft.	43.45	Time Delay Factor, min:	0.02

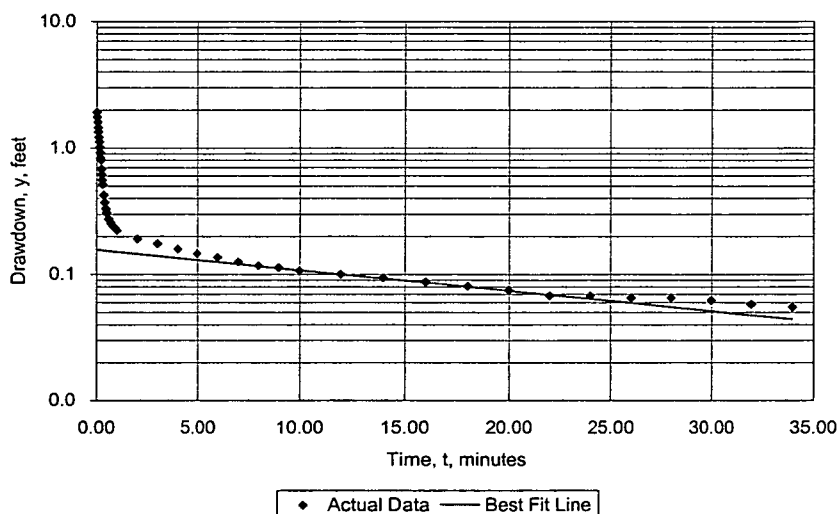
Computed Data

Effective Well Radius (Re), in.	2.0	Lw/Rw, ft/ft	18.93
Effective Screen Length (Le), ft.	6.31	Lw, ft	6.31
Full or Partial Penetration (F/P)	Partial	Le/Rw, ft/ft	18.93

Well Geometry Factors (See Attached Graph)

A	2.159	Note: - Factors A and B are used for a partially penetrating well - Factor C is used for a fully penetrating well
B	0.3275	
C		

BOUWER AND RICE SLUG TEST ANALYSIS



Regression Analysis (Ln y vs. t)

Slope of Line, (1/minutes):	0.037217378
Yo, ft	0.156752313
Ln(Re/rw)	1.746849214
Regression Coefficient, R ² :	100%

Determination of Hydraulic Conductivity

Conductivity, ft/minute	1.43E-04
ft/day	2.06E-01
cm/sec	7.27E-05
m/day	6.28E-02

Note: The first 5 minutes of data points are thought to represent filter pack drainage and the last 5 data points indicative of inherent deviation from linear recovery. These points are, therefore, not included in the linear regression analysis.

References:

- 1) Bouwer, Herman. The Bouwer and Rice Slug Test - An Update. Groundwater. June 1989.
- 2) Bouwer, Herman and Rice, R.C. A Slug test for Determining Hydraulic Conductivity of Unconfined Aquifers with Completely or Partially Penetrating Wells. Water Resources Research. June 1976

BOUWER AND RICE SLUG-OUT TEST ANALYSIS
MONITORING WELL MW-2
Monona County Landfill
Monona County, Iowa
Project No. 40915034

Elapsed Time minutes	Corrected Time (t) minutes	Depth to Water feet	Drawdown feet	Predicted Drawdown feet
0.0200	0.0034	39.06	1.92	0.156732479
0.0400	0.0234	38.895	1.755	0.156615859
0.0600	0.0434	38.74	1.6	0.156499326
0.0800	0.0634	38.588	1.448	0.156382879
0.1000	0.0834	38.472	1.332	0.156266519
0.1200	0.1034	38.355	1.215	0.156150246
0.1400	0.1234	38.255	1.115	0.156034059
0.1600	0.1434	38.149	1.009	0.155917959
0.1800	0.1634	38.055	0.915	0.155801945
0.2000	0.1834	37.968	0.828	0.155686017
0.2200	0.2034	37.942	0.802	0.155570176
0.2400	0.2234	37.819	0.679	0.155454421
0.2600	0.2434	37.757	0.617	0.155338752
0.2800	0.2634	37.699	0.559	0.155223169
0.3000	0.2834	37.654	0.514	0.155107672
0.3500	0.3334	37.564	0.424	0.154819305
0.4000	0.3834	37.512	0.372	0.154531474
0.4500	0.4334	37.47	0.33	0.154244179
0.5000	0.4834	37.447	0.307	0.153957418
0.6000	0.5834	37.415	0.275	0.153385494
0.7000	0.6834	37.396	0.256	0.152815694
0.8000	0.7834	37.383	0.243	0.152248011
0.9000	0.8834	37.373	0.233	0.151682437
1.0000	0.9834	37.363	0.223	0.151118964
2.0000	1.9834	37.331	0.191	0.145598086
3.0000	2.9834	37.315	0.175	0.140278904
4.0000	3.9834	37.299	0.159	0.135154049
5.0000	4.9834	37.286	0.146	0.130216423
6.0000	5.9834	37.276	0.136	0.125459184
7.0000	6.9834	37.266	0.126	0.120875743
8.0000	7.9834	37.257	0.117	0.11645975
9.0000	8.9834	37.253	0.113	0.112205089
10.0000	9.9834	37.247	0.107	0.108105864
12.0000	11.9834	37.24	0.1	0.100351218
14.0000	13.9834	37.234	0.094	0.093152828
16.0000	15.9834	37.227	0.087	0.086470793
18.0000	17.9834	37.221	0.081	0.080268073
20.0000	19.9834	37.215	0.075	0.074510286
22.0000	21.9834	37.208	0.068	0.069165517
24.0000	23.9834	37.208	0.068	0.064204139
26.0000	25.9834	37.205	0.065	0.05959865
28.0000	27.9834	37.205	0.065	0.055323522
30.0000	29.9834	37.202	0.062	0.051355057
32.0000	31.9834	37.198	0.058	0.047671258
34.0000	33.9834	37.195	0.055	0.044251705

BOUWER AND RICE SLUG-OUT TEST ANALYSIS

MONITORING WELL MW-3

Monona County Landfill

Monona County, Iowa

Project No. 40915034

Well Geometry

Saturated Thickness (H), ft.	20	Radius of Well Casing (Rc), in	1
Screen Length, ft.	15	Radius of Boring (Rw), in	4
Depth to Water, ft.	50.52	Gravel Pack Porosity (n), %	20%
Well Depth, ft.	65.65	Time Delay Factor, min:	0.23

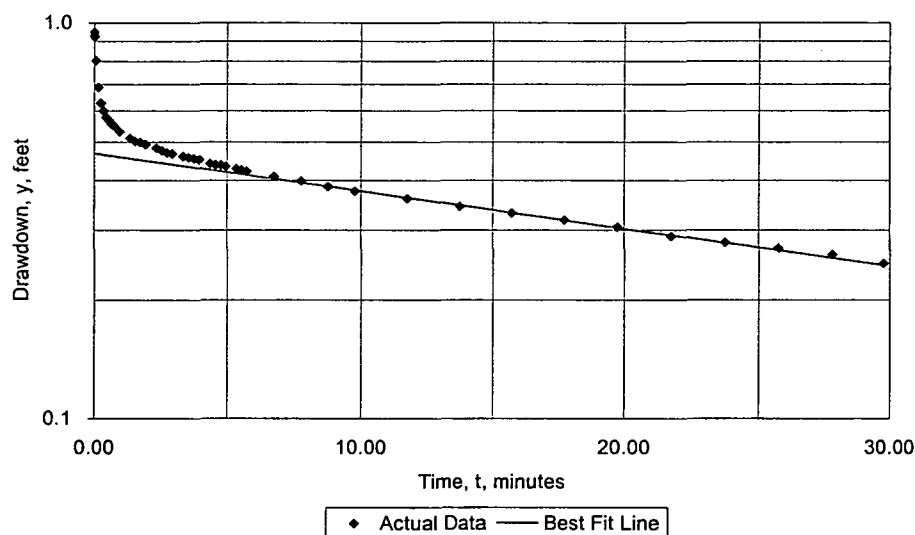
Computed Data

Effective Well Radius (Re), in.	2.0	Lw/Rw, ft/ft	45.39
Effective Screen Length (Le), ft.	15	Lw, ft	15.13
Full or Partial Penetration (F/P)	Partial	Le/Rw, ft/ft	45

Well Geometry Factors (See Attached Graph)

A	2.925	Note: - Factors A and B are used for a partially penetrating well - Factor C is used for a fully penetrating well
B	0.4675	
C		

BOUWER AND RICE SLUG TEST ANALYSIS



Regression Analysis (Ln y vs. t)

Slope of Line, (1/minutes):	0.021828061
Yo, ft	0.468494807
Ln(Re/rw)	2.623477841
Regression Coefficient, R^2:	100%

Determination of Hydraulic Conductivity

Conductivity, ft/minute	5.30E-05
ft/day	7.64E-02
cm/sec	2.70E-05
m/day	2.33E-02

Note: The first 5 minutes of data points are thought to represent filter pack drainage. These points are, therefore, not included in the linear regression analysis.

References:

- 1) Bouwer, Herman. The Bouwer and Rice Slug Test - An Update. Groundwater. June 1989.
- 2) Bouwer, Herman and Rice, R.C. A Slug test for Determining Hydraulic Conductivity of Unconfined Aquifers with Completely or Partially Penetrating Wells. Water Resources Research. June 1976

BOUWER AND RICE SLUG-OUT TEST ANALYSIS
MONITORING WELL MW-3
Monona County Landfill
Monona County, Iowa
Project No. 40915034

Elapsed Time minutes	Corrected Time (t) minutes	Depth to Water feet	Drawdown feet	Predicted Drawdown feet
0.2333	0.0000	51.468	0.948	0.468494807
0.2366	0.0033	51.449	0.929	0.468461062
0.2400	0.0067	51.442	0.922	0.468426296
0.3000	0.0667	51.323	0.803	0.467813207
0.4000	0.1667	51.207	0.687	0.466793175
0.5000	0.2667	51.148	0.628	0.465775368
0.6000	0.3667	51.119	0.599	0.464759779
0.7000	0.4667	51.097	0.577	0.463746405
0.8000	0.5667	51.087	0.567	0.462735241
0.9000	0.6667	51.074	0.554	0.461726281
1.0000	0.7667	51.068	0.548	0.460719521
1.2000	0.9667	51.051	0.531	0.458712582
1.6000	1.3667	51.032	0.512	0.454724894
1.8000	1.5667	51.022	0.502	0.452744068
2.0000	1.7667	51.019	0.499	0.450771871
2.2000	1.9667	51.013	0.493	0.448808265
2.6000	2.3667	51.003	0.483	0.444906677
2.8000	2.5667	50.996	0.476	0.442968621
3.0000	2.7667	50.99	0.47	0.441039007
3.2000	2.9667	50.987	0.467	0.439117798
3.6000	3.3667	50.98	0.46	0.435300451
3.8000	3.5667	50.977	0.457	0.433404241
4.0000	3.7667	50.974	0.454	0.43151629
4.2000	3.9667	50.971	0.451	0.429636563
4.6000	4.3667	50.961	0.441	0.425901639
4.8000	4.5667	50.958	0.438	0.42404637
5.0000	4.7667	50.958	0.438	0.422199183
5.2000	4.9667	50.954	0.434	0.420360043
5.6000	5.3667	50.948	0.428	0.416705761
5.8000	5.5667	50.945	0.425	0.41489055
6.0000	5.7667	50.942	0.422	0.413083247
7.0000	6.7667	50.929	0.409	0.404164138
8.0000	7.7667	50.919	0.399	0.395437607
9.0000	8.7667	50.906	0.386	0.386899495
10.0000	9.7667	50.896	0.376	0.378545734
12.0000	11.7667	50.88	0.36	0.36237543
14.0000	13.7667	50.864	0.344	0.346895872
16.0000	15.7667	50.851	0.331	0.332077552
18.0000	17.7667	50.838	0.318	0.317892225
20.0000	19.7667	50.825	0.305	0.304312851
22.0000	21.7667	50.809	0.289	0.291313546
24.0000	23.7667	50.799	0.279	0.278869532
26.0000	25.7667	50.79	0.27	0.266957087
28.0000	27.7667	50.78	0.26	0.255553505
30.0000	29.7667	50.767	0.247	0.244637049

BOUWER AND RICE SLUG-OUT TEST ANALYSIS

MONITORING WELL MW-4

Monona County Landfill

Monona County, Iowa

Project No. 40915034

Well Geometry

Saturated Thickness (H), ft.	20	Radius of Well Casing (Rc), in	1
Screen Length, ft.	15	Radius of Boring (Rw), in	4
Depth to Water, ft.	53.31	Gravel Pack Porosity (n), %	20%
Well Depth, ft.	68.35	Time Delay Factor, min:	0.08

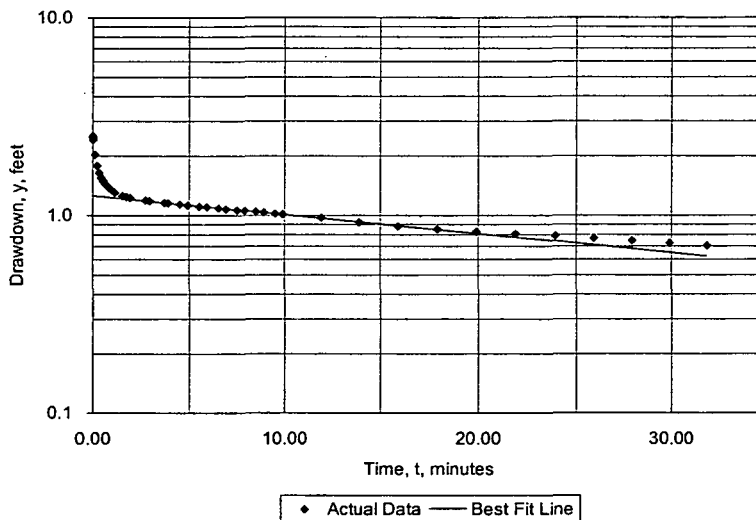
Computed Data

Effective Well Radius (Re), in.	2.0	Lw/Rw, ft/ft	45.12
Effective Screen Length (Le), ft.	15	Lw, ft	15.04
Full or Partial Penetration (F/P)	Partial	Le/Rw, ft/ft	45

Well Geometry Factors (See Attached Graph)

A	2.925	Note: - Factors A and B are used for a partially penetrating well - Factor C is used for a fully penetrating well
B	0.4675	
C		

BOUWER AND RICE SLUG TEST ANALYSIS



Regression Analysis (Ln y vs. t)

Slope of Line, (1/minutes):	0.022034528
Yo, ft	1.255782342
Ln(Re/rw)	2.619067996
Regression Coefficient, R ² :	100%

Determination of Hydraulic Conductivity

Conductivity, ft/minute	5.34E-05
ft/day	7.69E-02
cm/sec	2.72E-05
m/day	2.35E-02

Note: The first 1.5 minutes of data points are thought to represent filter pack drainage & the last 4 data points indicative of inherent deviation from linear recovery. These points are, therefore, not included in the linear regression analysis.

References:

- 1) Bouwer, Herman. The Bouwer and Rice Slug Test - An Update. Groundwater. June 1989.
- 2) Bouwer, Herman and Rice, R.C. A Slug test for Determining Hydraulic Conductivity of Unconfined Aquifers with Completely or Partially Penetrating Wells. Water Resources Research. June 1976

BOUWER AND RICE SLUG-OUT TEST ANALYSIS
MONITORING WELL MW-4
Monona County Landfill
Monona County, Iowa
Project No. 40915034

Elapsed Time minutes	Corrected Time (t) minutes	Depth to Water feet	Drawdown feet	Predicted Drawdown feet
0.0766	0.0000	55.833	2.523	1.255782342
0.0800	0.0034	55.817	2.507	1.255688266
0.0833	0.0067	55.787	2.477	1.255596963
0.0900	0.0134	55.755	2.445	1.255411611
0.1000	0.0234	55.716	2.406	1.255135018
0.2000	0.1234	55.335	2.025	1.252372432
0.3000	0.2234	55.093	1.783	1.249615926
0.4000	0.3234	54.95	1.64	1.246865488
0.5000	0.4234	54.863	1.553	1.244121103
0.6000	0.5234	54.805	1.495	1.241382759
0.7000	0.6234	54.76	1.45	1.238650442
0.8000	0.7234	54.718	1.408	1.235924139
0.9000	0.8234	54.689	1.379	1.233203837
1.0000	0.9234	54.66	1.35	1.230489522
1.2000	1.1234	54.611	1.301	1.225078802
1.6000	1.5234	54.566	1.256	1.214328633
1.8000	1.7234	54.55	1.24	1.208988976
2.0000	1.9234	54.537	1.227	1.203672798
2.8000	2.7234	54.501	1.191	1.182640825
3.0000	2.9234	54.491	1.181	1.177440506
3.8000	3.7234	54.466	1.156	1.156866894
4.0000	3.9234	54.462	1.152	1.151779908
4.6000	4.5234	54.443	1.133	1.136652768
5.0000	4.9234	54.433	1.123	1.126678545
5.6000	5.5234	54.417	1.107	1.111881079
6.0000	5.9234	54.411	1.101	1.10212423
6.6000	6.5234	54.394	1.084	1.087649254
7.0000	6.9234	54.385	1.075	1.078105041
7.6000	7.5234	54.372	1.062	1.063945525
8.0000	7.9234	54.365	1.055	1.054609314
8.6000	8.5234	54.353	1.043	1.040758385
9.0000	8.9234	54.343	1.033	1.031625643
9.6000	9.5234	54.33	1.02	1.018076574
10.0000	9.9234	54.323	1.013	1.009142867
12.0000	11.9234	54.281	0.971	0.965636575
14.0000	13.9234	54.233	0.923	0.924005932
16.0000	15.9234	54.188	0.878	0.884170074
18.0000	17.9234	54.159	0.849	0.846051625
20.0000	19.9234	54.136	0.826	0.809576543
22.0000	21.9234	54.117	0.807	0.774673979
24.0000	23.9234	54.097	0.787	0.741276139
26.0000	25.9234	54.075	0.765	0.70931815
28.0000	27.9234	54.055	0.745	0.678737939
30.0000	29.9234	54.033	0.723	0.649476105
32.0000	31.9234	54.013	0.703	0.621475811

BOUWER AND RICE SLUG-OUT TEST ANALYSIS

MONITORING WELL MW-5

Monona County Landfill

Monona County, Iowa

Project No. 40915034

Well Geometry

Saturated Thickness (H), ft.	20	Radius of Well Casing (Rc), in	1
Screen Length, ft.	15	Radius of Boring (Rw), in	4
Depth to Water, ft.	104.77	Gravel Pack Porosity (n), %	20%
Well Depth, ft.	122.47	Time Delay Factor, min:	0.93

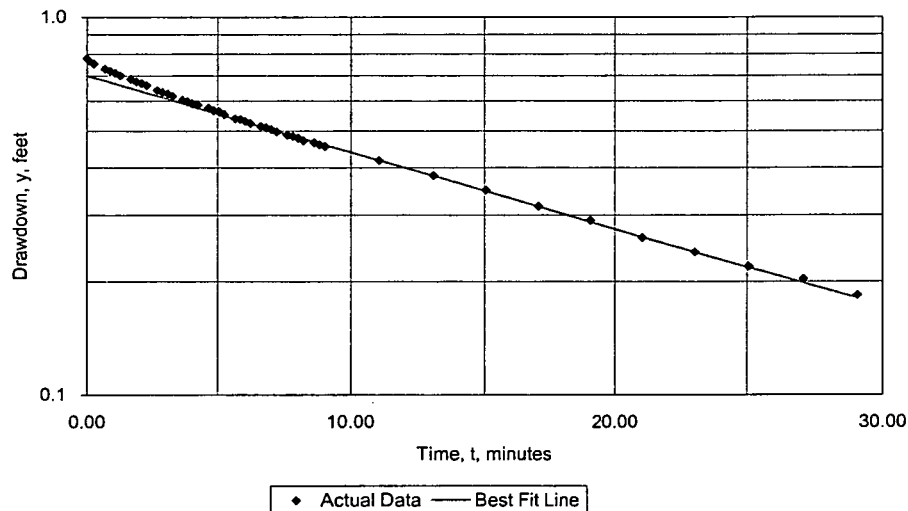
Computed Data

Effective Well Radius (Re), in.	2.0	Lw/Rw, ft/ft	53.1
Effective Screen Length (Le), ft.	15	Lw, ft	17.7
Full or Partial Penetration (F/P)	Partial	Le/Rw, ft/ft	45

Well Geometry Factors (See Attached Graph)

A	2.925	Note: - Factors A and B are used for a partially penetrating well - Factor C is used for a fully penetrating well
B	0.4675	
C		

BOUWER AND RICE SLUG TEST ANALYSIS



Regression Analysis (Ln y vs. t)

Slope of Line, (1/minutes):	0.04665861
Yo, ft	0.701011435
Ln(Re/rw)	2.762487441
Regression Coefficient, R^2:	100%

Determination of Hydraulic Conductivity

Conductivity, ft/minute	1.19E-04
ft/day	1.72E-01
cm/sec	6.07E-05
m/day	5.24E-02

Note: The first 3 minutes of data points are thought to represent filter pack drainage. These points are, therefore, not included in the linear regression analysis.

References:

- 1) Bouwer, Herman. The Bouwer and Rice Slug Test - An Update. Groundwater. June 1989.
- 2) Bouwer, Herman and Rice, R.C. A Slug test for Determining Hydraulic Conductivity of Unconfined Aquifers with Completely or Partially Penetrating Wells. Water Resources Research. June 1976

BOUWER AND RICE SLUG-OUT TEST ANALYSIS
MONITORING WELL MW-5
Monona County Landfill
Monona County, Iowa
Project No. 40915034

Elapsed Time minutes	Corrected Time (t) minutes	Depth to Water feet	Drawdown feet	Predicted Drawdown feet
0.9333	0.0000	105.548	0.778	0.701011435
1.0000	0.0667	105.539	0.769	0.698833188
1.2000	0.2667	105.523	0.753	0.692342204
1.6000	0.6667	105.5	0.73	0.679540547
1.8000	0.8667	105.49	0.72	0.673228759
2.0000	1.0667	105.481	0.711	0.666975597
2.2000	1.2667	105.471	0.701	0.660780517
2.6000	1.6667	105.455	0.685	0.648562447
2.8000	1.8667	105.445	0.675	0.642538394
3.0000	2.0667	105.439	0.669	0.636570294
3.2000	2.2667	105.429	0.659	0.630657627
3.6000	2.6667	105.41	0.64	0.618996541
3.8000	2.8667	105.403	0.633	0.613247105
4.0000	3.0667	105.397	0.627	0.607551071
4.2000	3.2667	105.387	0.617	0.601907945
4.6000	3.6667	105.374	0.604	0.59077845
4.8000	3.8667	105.368	0.598	0.585291113
5.0000	4.0667	105.361	0.591	0.579854744
5.2000	4.2667	105.355	0.585	0.574468869
5.6000	4.6667	105.345	0.575	0.563846733
5.8000	4.8667	105.335	0.565	0.558609546
6.0000	5.0667	105.332	0.562	0.553421003
6.2000	5.2667	105.322	0.552	0.548280654
6.6000	5.6667	105.309	0.539	0.538142747
6.8000	5.8667	105.306	0.536	0.533144307
7.0000	6.0667	105.3	0.53	0.528192294
7.2000	6.2667	105.293	0.523	0.523286277
7.6000	6.6667	105.284	0.514	0.513610525
7.8000	6.8667	105.28	0.51	0.508839948
8.0000	7.0667	105.274	0.504	0.504113681
8.2000	7.2667	105.267	0.497	0.499431314
8.6000	7.6667	105.258	0.488	0.490196649
8.8000	7.8667	105.254	0.484	0.485643547
9.0000	8.0667	105.248	0.478	0.481132736
9.2000	8.2667	105.241	0.471	0.476663823
9.6000	8.6667	105.235	0.465	0.467850137
9.8000	8.8667	105.229	0.459	0.463504597
10.0000	9.0667	105.225	0.455	0.459199419
12.0000	11.0667	105.187	0.417	0.418286816
14.0000	13.0667	105.151	0.381	0.381019342
16.0000	15.0667	105.119	0.349	0.347072232
18.0000	17.0667	105.086	0.316	0.316149658
20.0000	19.0667	105.06	0.29	0.287982145
22.0000	21.0667	105.031	0.261	0.262324231
24.0000	23.0667	105.009	0.239	0.238952322
26.0000	25.0667	104.989	0.219	0.217662745
28.0000	27.0667	104.973	0.203	0.198269973
30.0000	29.0667	104.954	0.184	0.18060501